NATIONAL AIRCRAFT SHOW NUMBER

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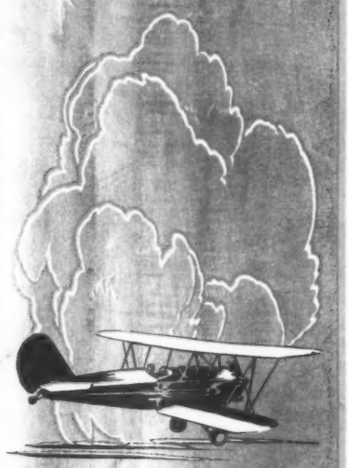

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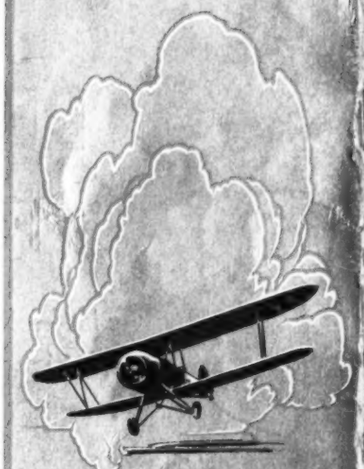

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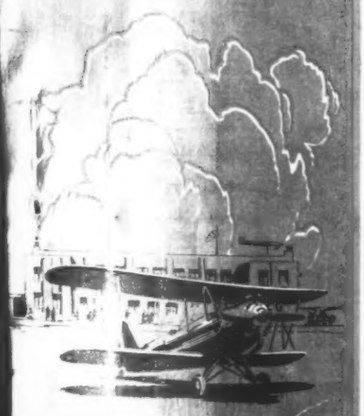

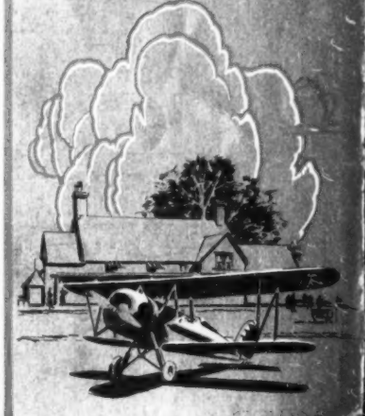

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AVIATION

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The Oldest American Aeronautical Magazine

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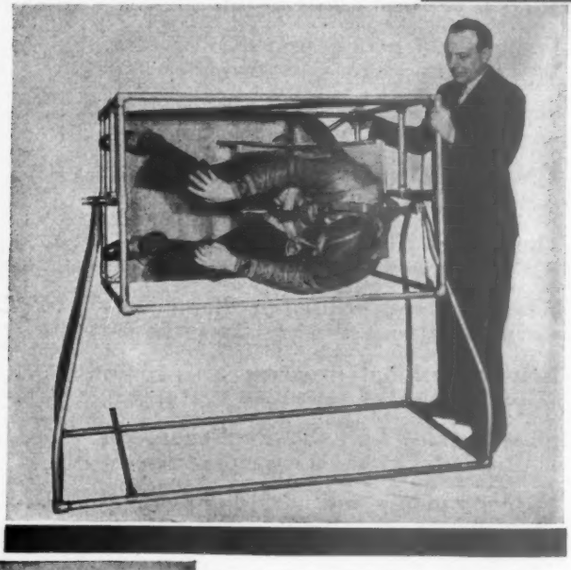

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The Autogiro Company of America is an engineering and licensing organization. It owns and controls, exclusively, all Autogiro patent rights in the United States. Manufacturing companies of high standing will be licensed to build Autogiros with the full cooperation of our engineering staff. Present licensees are: Buhl Aircraft Company, St. Clair, Mich. . . . Kellett Aircraft Corp.,* Philadelphia, Pa. . . . Pitcairn Aircraft, Inc.,* Willow Grove, Pa. . . . F. W. Steere Company, Bar Building, White Plains, N. Y.
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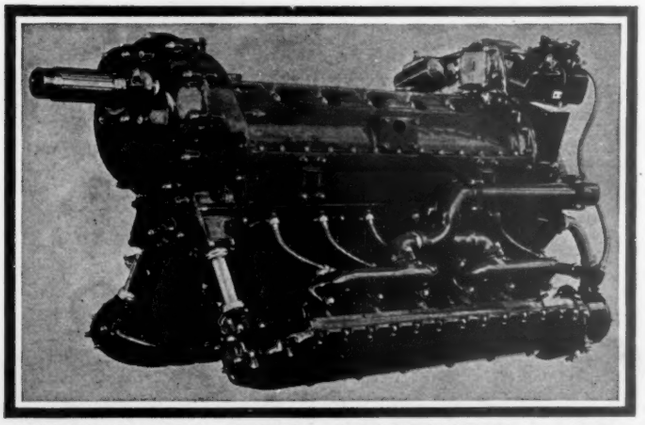

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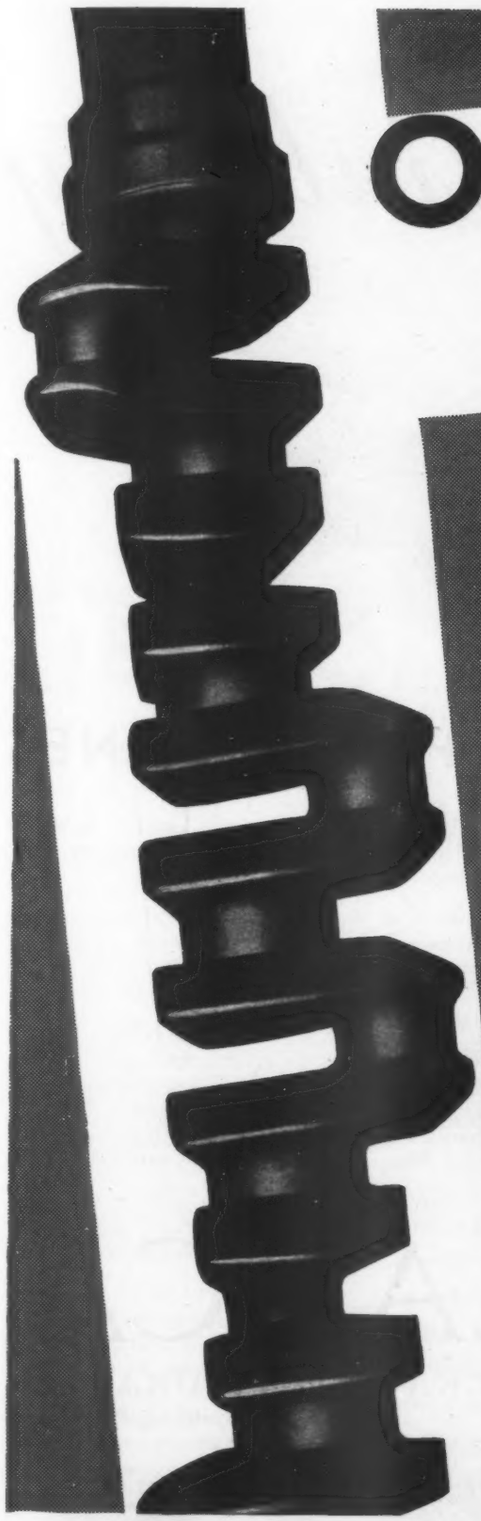

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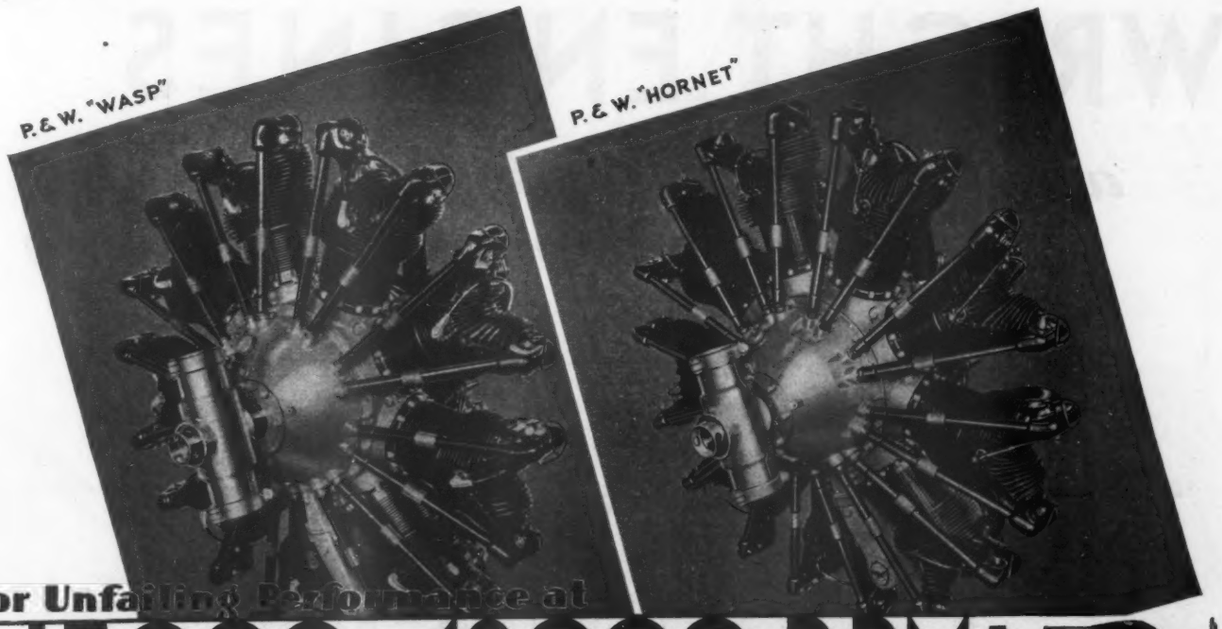

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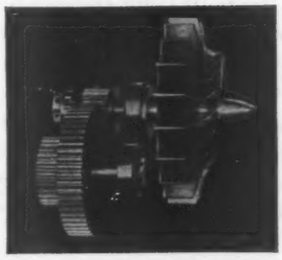

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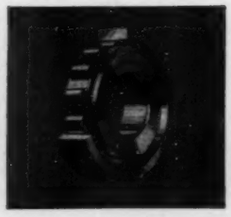

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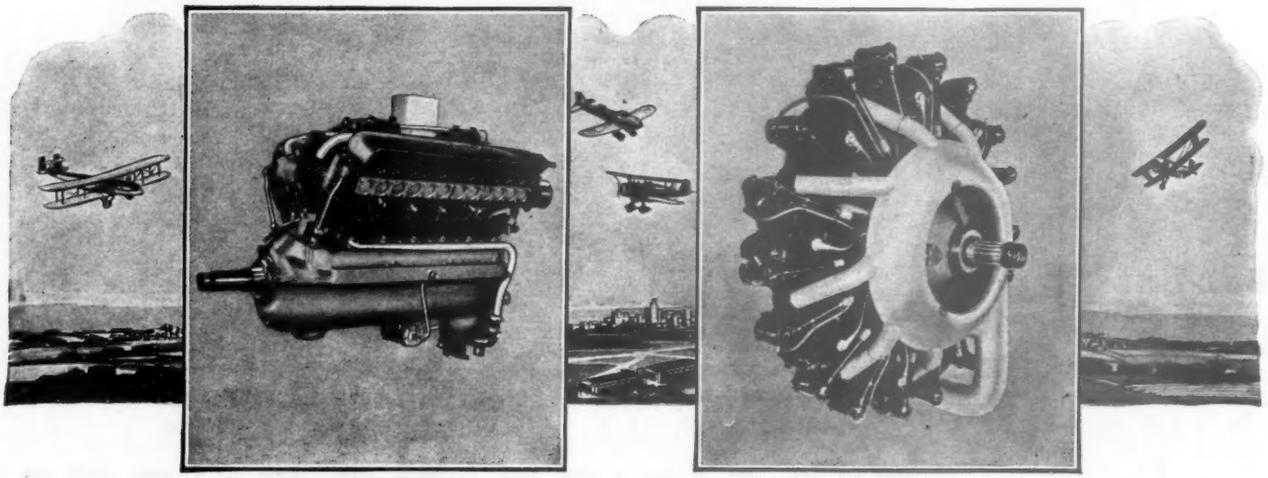

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AVIATION
FOR APRIL, 1932

The Detroit Show in prospect

A glance into the exposition building at the Detroit City Airport before the curtain rises on the Second National Aircraft Show

IN ACCORD with the usual custom, the annual display of wares of the aeronautic industry will be held at Detroit City Airport. At the time of writing there is an excellent probability of filling the world's largest hangar with a group of airplanes, engines, and accessories, whose makers face the future courageously after the most critical period of the history of aviation. The products to be displayed represent the results of a long period of research made possible through the leisurely production pace of the past year. Some of them are fundamentally novel. Many show important improvements in detail design.

Management plans

In show management the principal innovation is to be an international model transport line, to be operated jointly by several leading operators over a route 60 miles in length during the nine-day period of the show (from April 2 to 10, inclusive). This route is to be similar to the one operated during the Four Fields Flying Show last year in New York and will comprise a closed circuit of five airports, including the field where the exposition is to be held. The arrangement is to afford a complete circuit trip at a fare of $5 per passenger, and should provide an additional source of revenue to the show from visitors coming in from the other airports,—Ford, Grosse Isle, Wayne County, and Walkerville in Canada. At least half-hourly service is to be maintained.

Inspired by the excellent decorative work of Arthur J. Beer in the Ford exhibitions of the two previous years, the show committee, headed as usual by Ray Cooper, has retained Mr. Beer to design decorations for the entire floor. An exterior setting will be simulated, and all upright girders of the hangar structure camouflaged to represent trunks of trees. The leaves and branches from the trees will form an arch over each aisle. The sylvan effect will be broken only by the ornamental columns bearing lights and airway names at the intersections.

An examination of the exhibition plans reveals a definite trend toward specialization. There will be few general utility planes at the show. Never before have the private owner designs reflected so completely the needs of their prospective users. Such details as baggage compartments, so often slighted in the pressure of production, have been considered carefully. Detachable winter enclosures are found in many types of planes, from the Aeronca to the autogiro. The one private-owner convenience that seems to have been neglected, except in a few cases, is the folding wing, and this is no doubt due to the unfortunate prejudices against this type of machine that have arisen in America. But a return of folding wings to favor seems inevitable, when the storage expense for the private flyer is considered.

Ever-increasing power output and reduced specific weight are the highlights in the engine exhibition. Indication of the future trend in engine design is found in the accessory group. Several of these exhibits will contain devices designed in anticipation of even higher power output than that of the engines introduced this year. Engines in unprecedentedly high power ranges are now in the experimental laboratories of leading power-plant producers.

Airplanes

Although airplanes at the show will be fewer in number than at some of the previous expositions, the group will show the results of a more serious consideration of the demand for various specific classes of machines, during the long period of research made possible by reduced production activities throughout the industry. It is expected that the huge transport recently completed by the Ford Company will be exhibited at the show. If this proves to be the case, the machine should be one of the outstanding features. This plane is described in detail elsewhere in this issue.

At the other extreme of the range will be several of the surviving light planes, and in the intermediate class will be found private owner designs all better suited to the service for which they are intended than any of their predecessors. At least one of the medium weight transport machines, has been designed specifically for transport purposes on the basis of experience gained over a long period of scheduled operation.

A 12-lb. metal and pyralin winter enclosure and an oleo landing gear of unique design, distinguish the new Aeronca airplane, developed by the Aeronautical Corporation of America, and two "Collegian" models, one with landing gear and the other with floats, will comprise this exhibit. The Aeronca

A map of the show hangar, program, and a list of exhibitors appears on page 173

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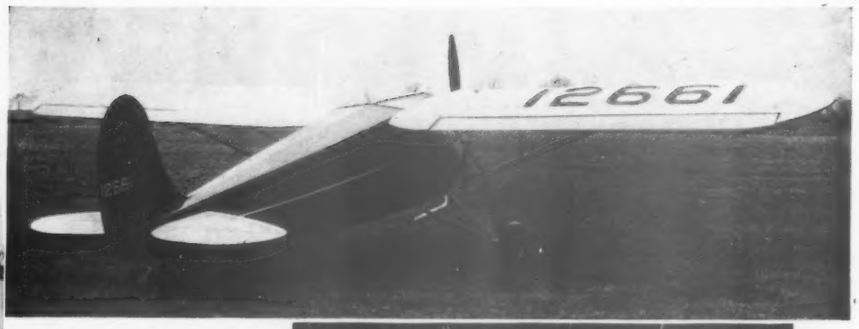
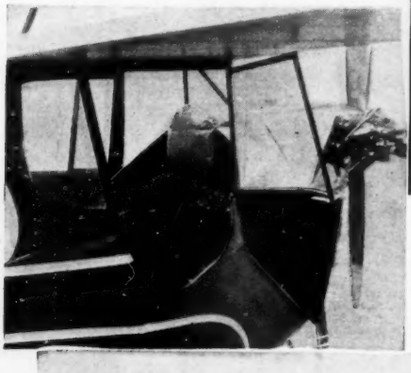
Right: The Fairchild-24 with the inverted Cirrus engine. Below: An Aeronca for two persons and cross country flying, with a winter enclosure and an improved engine.





Right: Recent General Electric instrument developments are installed in the G.E. Stinson, The plane is powered with a Wasp Junior.

Left: World's fastest single-seat air-cooled pursuit plane—the Boeing Wasp P-12E of all-metal monocoque construction

Above: Increased power and greater rotor area characterize the Pitcairn sport autogiro. (160-hp. Kinner). Left: The 240-hp. Whirlwind-powered Travel Air Speedwing. The plane is also available with engines of 300 hp. and 400 hp.

E-113A engine embodies a new head design with improved valve action and is the standard power plant.

The latest model of the Privateer with continental engine is to be shown by Amphibions Inc. This machine is a three-place amphibion, having a hull of unusual design, employing an aluminum alloy bottom and fabric covering for the sides and top with a welded steel tube structure.

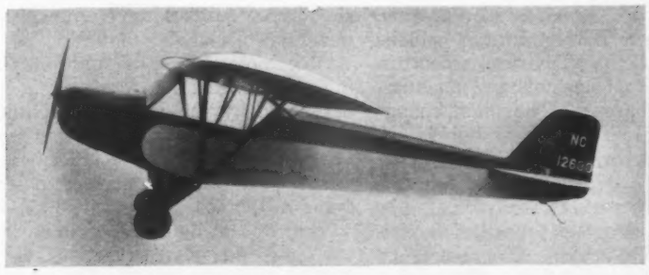
The American airplane and Engine Company will show the Pilgrim 100-A transport plane, described in the November issue of AVIATION (page 654).

One representative of each of its standard commercial models, the Pacemaker, Skyrocket and Air Bus, will constitute the display of the Bellanca Aircraft Corporation. The already high efficiency of the Bellanca wing has been increased and the parasite resistance has been decreased, particularly in the Pacemaker and Skyrocket models, through the introduction of a new low-drag design of landing gear.

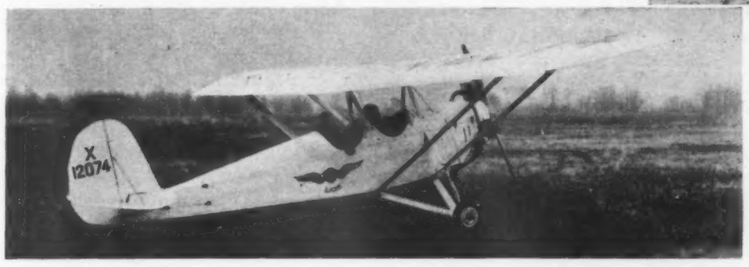
Five models will be displayed by the Bird Aircraft Corporation, featuring Kinner, Jacobs and Challenger engines, as well as the Packard diesel. The diesel machine has been designed particularly for airmail service. A conventional open biplane with tandem cockpit arrangement, embodying installation of an automatic pilot control mechanism, is to be introduced to the industry by the Brazil Aircraft Corporation, Brazil, Ind.

Four commercial planes will be shown by the Curtiss-Wright Corporation through its subsidiary, the Curtiss-Wright Airplane Company. Two of them are of Travel Air type,—one a three-place Speedwing with a 240-hp. Whirlwind engine, the other the deluxe Speedwing with a 300-hp. Whirlwind. The "Duck" light amphibion, powered with the 90-hp. Warner engine and a Super Speedwing will be shown.

In a special effort to meet the needs of the non-professional flyer, the Fairchild Aviation Corporation has developed a high wing cabin monoplane, with side by side seating arrangement, and ample width of cockpit for such an arrangement. The machine is well proportioned and has exceptionally clean lines. It is designated "Fairchild 24" and powered with the American Cirrus inverted engine. An open machine of



Above: Greater fuel capacity, and excellent visibility are features of the Taylor Continental A-40 Cub.



Above: Baggage space is provided in sufficient quantity in the Waco Model A. A one-man winter enclosure is also a feature. Left: A newcomer among sport planes, the Brazil Aircraft Company's Lion monoplane.

similar design designated "22," essentially like that introduced last year, is also scheduled for exhibit.

A study of the service requirements of last year's airplanes has been the determining factor in refinement made by the Great Lakes Aircraft Corporation in the Sport Trainer. Larger cockpit opening, redesigned windshields, relocation of baggage compartments, cowling redesign for greater engine accessability, are the more important change.

Hammond & Haddon, of Detroit, have bought manufacturing rights for the Parks & Ryan Speedster and will have a plane at the show.

An entirely new contribution to the sportsman market has been made by Mr. W. B. Kinner. The plane is a strut-braced, low wing monoplane type with a unique one-man folding wing arrangement and side by side seating for the two passengers. Distribution will be direct from the factory, and a time-payment plan requiring no insurance, has been arranged. The engine is a 100-hp. Kiner K-5.

The Monocoupe Corporation will have four of the well-known two-place cabin monoplanes powered by Lambert, Kinner, Velie and Warner engines, and will display, as a feature of the exhibit, a ton of trophies won by the Monocoupe plane in various competitions of recent months. Of the new models to be exhibited by the Nicholas-Beazley Airplane Company, one will be the NB-8 folding wing training monoplane, with either the Genet or Lambert engine.

Stinson Aircraft Corporation will display three models emphasizing the new model R Junior and the Model T Airliner. The Model R is a 1932 version of the familiar Stinson Junior and the Model "T" is a transport of 12-passenger capacity, and faster and more comfortable than the present Airliner. The power plant is the Lycoming engine.

Improved visibility and general refinement are embodied in the Continental Cub, two-place, light plane to be displayed by the Taylor Aircraft Company. The model to be shown is the improved design brought out late last fall.

Several of the insistent demands of non-professional owners are fulfilled in the Waco Model A biplane. This machine is available in a Continental, Warner Scarab, and three Kinner models of special importance to the non-professional owner are the one-man convertible winter top and the 100-lb. main baggage compartment ahead of the front seat, which has been provided in addition to the rear compartment.

The exhibit of the United Aircraft & Transport Corporation will include a Hornet Vought Corsair, a Wasp Junior S-39 Sikorsky, and a Wasp Boeing pursuit plane. It is possible that the Laird Solution 2, with which Major James Doolittle won the transcontinental derby during last year's National Air Races, will be included. The Boeing Pursuit Model P-12-E is ranked by the U. S. Army Air Corps as the fastest air-coooled pursuit plane in the world. It is a biplane type, different from the previous P-12 models in that its fuselage is of all-metal, monocoque construction. It is equipped with a supercharged Wasp engine of about 500 hp.

Rotating wing machines

Thet Kellett Aircraft Corporation, making its first appearance at a national show, will exhibit two of the newly introduced autogiros. One of these is the Model K-2, two-place, open, side by side machine, powered by a Continental 165-hp. engine, while the other is the convertible Model K-3, also a two-place side by side design but with removable cabin enclosure. An improved relationship between rotor and fixed wing and their setting with respect to each other, as well as higher propeller efficiency obtained through blade selection, are factors contributing to the overall efficiency of the machine. Greater ground angle, relocation of tail surfaces for more sensitive control, and a rubber mounted power plant are also among the many improvements.

Pitcairn Aircraft will display the latest sport autogiro. This machine is similar to the PAA-1 introduced last year at Detroit, but considerably improved in appearance, performance, and design. The principal features are increased power and greater rotor area. A radial engine, 160-hp. Kinner, has replaced the six-cylinder, vertical.

A rotating wing aircraft essentially different in principle, rotor construction, and operation will be introduced by the Pennsylvania Aircraft Syndicate. It embodies a feathering rather than an articulated blade attachment.

Engines

An interesting series of inverted in line air-cooled engines will be introduced by the American Airplane & Engine Corporation. This group includes engines in a wide power range, all built on the same cylinder design, with interchangeability an important factor. A feature of the exhibit will be the twelve-cylinder inverted V series of V-770 and V-770SG models, which are respectively direct drive, direct carbureted and geared and supercharged versions of the Ranger engine. These power plants develop 270 hp. at 2,250 crankshaft r.p.m. and 340 hp. at 1,700 propeller r.p.m. respectively.

The complete line of engines comprising three, five, seven and nine-cylinder units of the Aeromarine Plane & Motor Company are to be on display.

Through the medium of increased bore the Continental Aircraft Engine

Company has stepped up the output of the familiar A-70 model to 210 hp. representing an increase of 45 hp. for a 25-lb. increase in weight and bringing the specific weight down to 1.98 lb. per hp. The new model which is known as the R-670 has a bore of 5¼ in. and a displacement of 668 cu.in. Overall and installation dimensions of the new engine remain the same as those of the A-70.

The Guiberson Diesel, was shown for the first time last year at Detroit, is now in commercial production. A 240-hp. unit will be displayed together with a cutaway model showing the principal parts. This engine is more completely described on page 195 of this issue.

Standard 170-hp. seven-cylinder engines, 55-hp. three-cylinder engines, and a showcase containing parts will constitute the exhibit of the Jacobs Engine Company.

Four radial power plants and a number of representative parts will be shown by the Kinner Airplane Motor Corporation. Considerable interest is expected to center around the R-5, a new 160-hp. engine, which weighs only 305 lb., or less than 2 lb. per hp. The other models to be shown are the familiar K-5, 100 hp.; B-5, 125 hp., and C-5, 210 hp.

To meet the demand for increased performance in transport plane design, the Pratt & Whitney Aircraft Company has brought about a new series of engines completely redesigned for increased output and lower specific weight. As a series, the engines all weigh less than 1½ lb. per hp. The Pratt & Whitney display will be centered around the Wasp Junior, The direct-drive Wasp and the geared supercharged Hornet.

Included in the exhibit of the Wright Aeronautical Corporation, which will occupy a portion of the Curtiss-Wright space, will be a cutaway Cyclone, 575 hp. with the E-type head, and the latest models of the Whirlwind, Challenger, and Gypsy engines. The supercharger clutch, now standard equipment on all engines, and the high compression piston of the new 400-hp. Whirlwind will be among the parts in the exhibit.

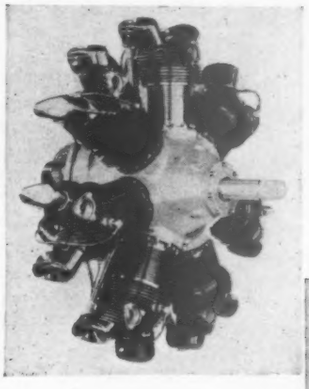
A newly-designed cylinder head a new model of higher compression ratio will be a feature of the exhibit of the Lycoming Manufacturing Company. One of the engines will be radio-shielded.

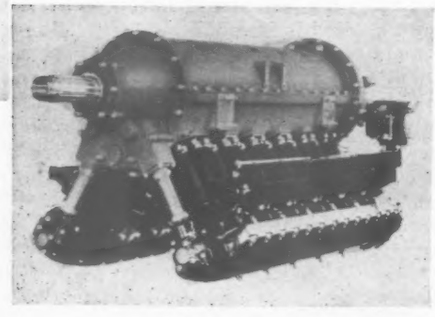
The diesel-powered Bellanca monoplane in which a non-refueling endurance record was made last year, will be the feature of the packard exhibit.

In addition to the 90 and 110-hp. engines developed by the Warner Aircraft Corporation, a 150-hp. unit is to be shown at Detroit.

Accessories

Products representing a long period of research, some of them entirely new, will be presented in the accessories exhibit of Bendix Aviation Corporation. Most strikingly novel offerings will be those of the Eclipse Division, a controllable pitch propeller hub and an automatic supercharger. The pitch changing feature of the propeller hub is entirely automatic, the blades being allowed to move torsionally within the hub against spring pressure. The weight of a complete propeller, including hub, is 57 lb. more than that of an ordinary metal propeller. The supercharger follows conventional centrifugal design, but has three new features,—entrance impeller, a controllable centrifugal clutch, and multi-speed impeller gearing. New carburetors, most of them designed for large engines now in the experimental stage, will be offered by the Stromberg division. In addition to a hydraulic brake, formerly exclusive with the Ford planes, but now adapted to all transport and cargo planes, fixed standard sizes of wheels embodying a high degree of simplicity in brake adjustments, will be featured by the Bendix Brake Company. Improved instruments and other equipment will be displayed by Pioneer, Friez, and Delco, and wood propellers for large engine and laboratory installation will constitute the major portion of the exhibit of the American Propeller Company.





Above: An output increase of 45 hp. has been attained by enlarging the bore in the Continental B-670 with a weight increase of but 25 lb. Right: A twelve-cylinder, inverted vee, air-cooled engine. The Ranger V-770 makes 270 hp. at 2,250 r.p.m.

Changes which provide greater length of service without attention, lower starting speeds and higher maximum speeds in anticipation of future progress in engine design have been embodied in the 1932 models of Scintilla magnetos. The newer V-AG series which supplanted the former AG types are equipped with ball bearing distributors furnished either for base of flange mounting and are now supplied profiled for radio shielding or factory equipped with radio shields. Scintilla battery ignition equipment will also be available.

A complete line of ignition shielding assemblies for aircraft engines will be shown by the Breeze Corporations, including two new harnesses for the Warner Scarab and Kinner engines. An important improvement has been made in the spark plug shield assembly, substituting a die-cast aluminum bonnet for the former plated type. A complete line of plugs for shielding conduits and fittings to be used in the shielding of light and power circuit aircraft will be shown. These fitting conduits conform with the most recent Army and Navy specifications.

The spark plug manufacturers will be represented by the B. G. Corporation, Champion and Hurley-Townsend. The H. T. Company will display a new type of copper-cooled spark plug, and the Champion Company a recently introduced radio-shielded plug.

The Hahn non-shielded spark plugs for non-radio equipped airplanes, a companion product to the previously presented Hahn radio-shielded spark plug will be shown by Walter Kidde & Company. Several types of lux fire fighting equipment for airplanes and airport installation will be included.

The devices manufactured by Aircraft Products Corporation, which was recently absorbed by the Warner Aircraft Corporation, will be included in the Warner exhibit.

Thirty Aerol shock struts, including oleo pneumatic units, oleo spring units, and tail skid units with wheels will be arranged in an exhibit of the Cleveland Pneumatic Tool Company.

Goggles, helmets, parachutes, clothing, instruments, parts and accessories will supplement the exhibit of airplanes and engines of the Curtiss-Wright Corporation, and the new electrically-operated controllable pitch propeller will also be in evidence.

A cutaway section of a standardized float model will be exhibited by the Edo Aircraft Corporation, together with a display of the automatic water rudder, developed by that company for its floats.

The complete line of instruments manufactured by the Elgin National

Watch Company will be available for examination. Radial engine cowling and the usual line of special streamline parts will be shown by the Hill Aircraft Streamliners Company and a wheel pants lifter, a device which makes wheel pants adjustable to any position necessary to conform with landing wheel conditions, is to be introduced. Plumbing supplies and sanitary equipment, primers, cocks, tube connections and service tools of the most recent design will be shown by the Imperial Brass Manufacturing Company.

Parachutes and parachute equipment of recent design will be included in the display of the Irving Air Chute Company and the Switlik Parachute and Equipment Company.

A very complete line of hollow steel propellers, embodying two airfoil designs and diameters ranging from 8 to 10 ft. will constitute the exhibit of Pittsburgh Screw & Bolt Corporation. The Dicks single-piece propeller hub which makes it possible to change blades or blade angles easily and quickly without disassembly of the propeller, will be one of the features of the exhibit.

For the first time at any aircraft show, a complete line of oil-reclaiming devices will be offered by the Skinner Motors, Incorporated. This display should be of particular interest to operators of the transport services.

A new type of fuel line testing machine, eliminating the necessity of using the olive joint, is to be one of the innovations offered by the Sky Specialties Corporation.

In a setting, the scene of which will be the several transatlantic and other famous flights in which Sperry instruments were used, the manufacturers of the artificial horizon and directional giro will display this device in actual operation so far as this is possible in the limitations of the exposition.

An operating demonstration of the Bosch diesel fuel injection equipment is to be the feature of the United American Bosch Corporation exhibit.

The accessory section of the United Aircraft and Transport exhibit will be devoted to the products of the Hamilton Standard Propeller Company. These include the regular line of aluminum alloy adjustable blade propellers and the controllable pitch propeller shown last year.

The new General Electric plane, a flying laboratory for purposes of instrument testing will be a major feature of the General Electric exhibit, and a complete line of instruments, superchargers, landing lights, ball bearing control pulleys, will be shown.

The Westinghouse Electric & Manufacturing Company will show rotating wheels, beacons, landing field floodlights, ceiling projectors, rotating beacons, wind and engine driven generators, micarta pulleys, fair leads, and many similar devices.

Materials, tools, equipment

A model paint manufacturing plant showing machinery in operation and spray booth with operator, will be a feature of the Berry Brothers exhibit. This will also include the usual line of Berry paint materials.

An effective presentation of castings and other fabricated parts of magnesium alloy has been arranged by the Dow Chemical Company.

Samples of Haskelite and Plymetl, including special insulating panels for cabin lining are to be featured by the Haskelite Manufacturing Corporation. A number of interesting applications of this material will be arranged in the exhibit. Wire, wire rope, insulated wire and cable for aeronautical use will be shown by John A. Roebling's Sons Company.

Specimens of oxy-acetylene welded airplane parts, Airco National Carbide, and Airco D-B welding and cutting equipment and supplies will be shown by the Air Reduction Sales Company of New York. Precision aircraft engineering parts such as value guides, piston pins, cam and rocker arm rollers and similar parts of bronze, aluminum, and steel will be displayed by the Ex-Cell-o Aircraft & Tool Corporation. In addition there will be a large assortment of broaches and broached parts and an interesting group of tungsten carbide tipped cutting tools and form tools.

Above: A multi-speed supercharger, a development of the Eclipse Aviation Corporation. Right: A die-cast aluminum bonnet in the new Breeze spark shield.

Three manufacturers will represent the bearing industry, which is becoming the increasingly important source of supply for aircraft manufacturers. The Fafnir Bearing Company will show its complete line for aeronautical use, including control surface applications such as double seal bearings, torque tube types, narrow series, inch dimension designs, and cartridge types. All of these are special designs for exclusive aircraft use. Ball, roller, and thrust bearings, with particular attention to those for aeronautical application, are to be shown by the Norma-Hoffmann Company. A number of moving devices illustrating the uses of roller bearings of the familiar Timken type will be set up in the booth of that company.

Assortment of streamline external and square section internal tie rods with terminal assemblies will be shown by the Stewart Hartshorn and Macwhyte companies. It has not yet been definitely decided, but it is possible that the Hartshorn company will show both the internal and external rods in the 18-8 grade stainless steel.

Double coupling, copper tubing plugs, refueling valves, double benders, and fabricating tools will be among the product displayed by the Parker Appliance Company.

The flexible gas and oil lines manufactured by the Titeflex Metal Hose Company are now approved by the Department of Commerce, and will be shown in the booth of the Nicholas-Beazley Company.

An interesting assortment of drop forgings are to be featured by the Wyman-Gordon Company.

Transport companies

Attractive exhibitions are planned by several of the major transport operators in an effort to familiarize the visiting public with their services. Transamerican Airlines Corporation will display a large illuminated map showing the routes over which its passenger, mail, and express services operate, as well as the various Thompson service stations.

New maintenance procedure and special servicing equipment will feature the sales and service organization's exhibit in the same space.

An illuminated neon map of the airways of the country with its routes in flashing colors will feature the exhibit of the United Air Lines. This display will also include a pictorial visualization of air transport of the past and present, and descriptive data on all of the United Air Lines subsidiaries will be available.

Stanavo Specifications Board, will furnish a booth with telephone service, writing desk, and other conveniences for visitors in addition to an interesting display of aviation fuels and oils. "Old Man Kendall," the entertaining young robot made of oil containers, will be on duty throughout the show in the Kendall space. The Shell and Texas companies will also be represented at the show.

The industry's executives classify their problems

Keystones of policy for 1932

William B. Mayo

Air transport faces a new era

By William B. Mayo

Chief Engineer, Ford Motor Company

AMERICAN air transport lines last year carried as many passengers as in 1930. The volume of mail was just as great. This was in the face of sharply reduced traffic on the railroads and other passenger carriers. Such an accomplishment means something.

Measured by the general yardstick of business in the past year, it might have been expected that the air transport industry would have shown a decrease in traffic. As the newest form of travel, we might have supposed it would have been hit worst.

But that was not the case. Instead of falling off, traffic was maintained on a level with the previous year. Distinctly, that is an achievement of which the industry well can be proud. It is fair to assume that if business generally had been normal air travel would have again shown an increase in 1931.

As far as operations were concerned, therefore, the aeronautics industry made a remarkable showing in 1931. The same was not true of the manufacturing phase of the industry.

The volume of business done by the plane and engine manufacturers last year fell considerably below that of previous years. This was to have been anticipated. Many factors entered into the situation.

One of the most *(Continued on page 164)*

Aviation progress on aviation profits

By Thomas A. Morgan

President, Curtiss-Wright Corporation

EVERYONE with any knowledge of conditions that exist today in the aeronautical industry must appreciate that when gauged by usual standards it has not been a tremendous success in the past several years. Of course, considerable progress has been made in the general category of development. This includes the development of air transportation, as well as engineering and research development in planes, engines and accessories. Under the circumstances, some outstanding achievements have been accomplished. We have now reached a point in this period of adolescence of the industry that, in my opinion, requires the development of sound cooperative effort in development activities, both in technical, as well as the business problems with which we are faced.

Today the industry, both manufacturing and transportation, is dependent almost entirely on the federal government for its present existence and future welfare. The government is certainly justified in rendering assistance; first, because it is essential that the United States have adequate air power as a means of nation- *(Continued on page 163)*

Thomas A. Morgan

P. G. Johnson

Air travel, on its own record

By P. G. Johnson

President, United Air Lines

ON United Air Lines we issue to every passenger a suggestion card inviting the passenger to record his impressions of the flight and to make suggestions for improvement of the service. From these cards we find how important it is to impress the public with the safety of flight.

Ninety-five per cent of the passengers are not only retained as frequent riders by the proper observance of safety measures but they become the best salesmen for lukewarm prospects the industry has. A check of the suggestion cards reveals that at least 35 per cent of the new passengers we have carried on United Air Lines in the last six months were induced to travel because some passenger had convinced them of the desirability and safety of flight. The little space for the check mark opposite the words "On recommendation of a friend" is filled out more frequently than any other check on the card.

Eighty per cent of the flying on our transport system, at least, is done by business men, many of them major executives. They are not the type to fly for the romance of the trip, but they do so because they feel the airplane saves time and is a valu- *(Continued on page 165)*

¶ The aircraft industry faces many problems. In an endeavor to find out how they look and how they rank in relative importance to the men who have to take the lead in solving them, we invited some of the leaders in the field to contribute brief statements for publication in AVIATION. Each of them was asked to select a specific question for discussion, and in no case was a definite subject assigned. In a few instances the shortness of the time and pressure of duties prevented compliance with our requests. ¶ One of the most interesting results of this compilation is the evidence it furnishes of the thought that is being given to the problem of selling the public on the safety of flight. Several of the contributions dwell upon that as the great issue. The discussions of the private market, and the interpretations of the very encouraging record of air transport through the depression period, are also of great interest.

G. M. Bellanca

Do business only at a profit

By George Waite

President, Irving Air Chute Company

I BELIEVE that we are on the verge of a new day in the aviation industry. The future is bright. But, whether or not we advance with the general improvement in business depends upon, frankly, how willing we are to face the fact that no business can continue indefinitely without profits. Important as an individual position of prestige may seem to be, the time is really past when any management should feel it the part of wisdom or necessity to do business at a loss in order to try to maintain such position.

Engineering activities should continue unabated, but they cannot continue without profits. Generally speaking, all retrenchments have been made in the industry that can safely be made. Perhaps some have gone too far.

Probably the great-*(Continued on page 162)*

The public and the safety of flight

By G. M. Bellanca

President, Bellanca Aircraft Corporation

AIRCRAFT manufacturers can do much constructive work in the direction of safety and increased sales by continuing to build safe planes and increasing that safety to the utmost, letting the public know that safe planes are being built, and by stressing the safety of flying at all times. The press can do a great deal to aid this movement by frequent publication of the mileage flown without accident. The constant placing before the public of such data will help to show the present status of air transportation, and place the aircraft industry in its true light.

The manufacturer's part is to keep on developing safety through refined design and new safety devices; the main means of doing this is to keep on improving airplanes, even if they should cost a little more. Instead of making so many different types of airplanes, and especially so many different models of the same type, we ought to concentrate on very few types, using all of our present-day knowledge and skill, and by this concentration reduce the cost of manufacture.

Safety is the first thing we have to demonstrate and prove to the public, and by doing this the public will become more convinced of the soundness of flying. At the present time, the public is almost safety-conscious as regards aircraft, and it takes just a little more to establish full confidence in flying. However, the fact that the public is not quite as safety-*(Continued on page 165)*

What's wrong with the aviation business?

By B. D. DeWeese

Vice-President, Stinson Aircraft Corporation

ASIDE from the general troubles from which practically all industries are suffering, much can be said about the specific ills of our industry and it is certain that economical distribution is the major problem to solve.

"We can now design and build airworthy planes at reasonable cost," says one prominent authority, "but we cannot sell them at a reasonable price as there is no such thing as an airplane dealer or distributor, and direct selling is very costly."

What of the flying field man, he was asked. "Well, he's broke and doesn't know how to sell airplanes anyway. He hasn't recovered from 1927 and 1928, re-adjusted his sights and gone to work. He is still waiting for another heyday."

Distribution is always the hardest task and we should not be too quick to blame the men who are doing more than any of us, not only in teaching people to fly, but also in convincing the general public that travel by air has now become a safe and speedy means of going places and getting back and that the airplane has now been perfected to a point where it compares favorably with the reliability of a good motor car.

What have we, as manufacturers, done to help our only means of distribution? The men who are operating the hundreds of fields throughout the country are our only means of selling airplanes to the public unless we go into a more expensive subsidiary sales and service branch system of our own. Those who have tried that are used to looking at red figures. On what basis then, can we indict the flying field man? He has had tough going! His hangar may be filled with planes in dead storage; he cannot sell gas, oil, or repairs to these owners. He used to make good money on air taxi work but this business has fallen off and rates have been cut below cost. His repair business has decreased due to the development of better airplanes and less flying per plane during the past two years. He has been able to sell only a few planes per year, if any, as the per capita consumption was greatly reduced in 1930-31 and he therefore needs capital as well as new enthusiasm to enable him to come back to share in the better times which are just ahead as he has learned through experience that common sense, hard work, economy will *(Continued on page 165)*

Speed is what we have to sell

By Carl B. Squier

General Manager, Lockheed Aircraft Corporation

SPEED is the pedestal upon which American business is founded, and speed is the reason for the creation of air systems. The value of the airplane is almost entirely controlled by the speed which it makes, and its value to mankind can only be measured by virtue of its ability to shrink distances.

The racing plane of today is the passenger ship of tomorrow, for the lessons learned through engineering and research necessary for the fabrication of a fast racing plane are embodied with certain restrictions in the modern air transport.

The manufacturer of high speed single-engined transports has a difficult problem in that when he passes conventional speeds there are no strictly accurate engineering data which he may use for reference. This is especially true in the mechanical and aerodynamical problems involved in a low-wing ship with retractable landing gear. Pioneering along these lines naturally involves extensive research and experimentation, and after many trials, which if proven successful, structural and performance data is available for other manufacturers to follow.

From the air operator's point of view speed is mandatory, because it means more pounds or more passenger miles per hour from the same investment and operating cost. The airplane is the only vehicle where the cost of operation is reckoned by the hour. Therefore, with the increase of speed we decrease the cost per pound or passenger mile, resulting in making it possible to operate lower fares and increased schedules.

The lesser cost of operation is necessary if the airlines are to succeed; and lower fares are mandatory if the operators are to have sufficient patronage to justify the service.

We feel that the manufacturer's problem is to produce for the airline operator greater speeds with given horsepower, commensurate with safety and comfort. The manufacturer must realize that the future of his factory depends on the satisfaction of his users; and therefore his problem is to so fabricate his equipment that the operator's success is assured. He must feel that his obligation to the consumer has just started upon the delivery of a plane, and that cooperation and service after acquisition of the equipment are the two greatest selling factors for a continuance of relations and future business.

Another problem which every manufacturer must decide is, on the one hand, absolute necessity for constant improvement, developments and research tending towards speed, comfort, and lower operating and maintenance cost; and on the other hand, the necessary financial retrenchment which good business dictates.

Carl B. Squier

George Waite

(Continued from page 161) est obstacle to profits today is the discount evil. Great pressure is being continually placed upon manufacturers by dealers in their demands for greater discounts. It has become a wide-spread evil. It might not be so bad if the dealers actually reaped the benefit from large discounts. But quite the contrary is the case and dealers almost everywhere are indulging in a price-cutting orgy, in which they pass their discount benefits on to the consumer. This has resulted in a market demoralization which has made the buying public hesitant and suspicious, defeating the very object everyone in the industry today should wish to attain. In other words, customers have reached the point where they shop around and hardly ever feel that they really know the actual lowest price at which they can buy. Vigorous moves must be made to overcome this condition.

It would be in bad taste for the Irving Air Chute Company to make a statement of this kind were it not prepared to make a definite declaration of policy in the matter. Within the last few days, notice of a new price and discount schedule has been given to those dealing in our products. This is effective immediately.

The new schedule is intended to give the customer the utmost for his money in quality and service, and to give the dealer a fair and honest compensation for his service in making the sale. It is intended that dealers adhere strictly to this schedule. I have no hesitation in saying that any dealer detected in passing a part of his discount onto his customer and otherwise cutting prices will be crossed off the list of Irving agents. We believe that such a policy is absolutely essential to stabilize the industry and bring back to it a full measure of confidence on the part of the purchasing public.

Finding economic reasons for plane ownership

By D. A. Luscombe

Vice-President, Monocoupe Corporation

ONE who has been instrumental in exploiting an early outburst of enthusiasm for the tremendous possibilities of aviation, particularly in the sense of private flying, can view the first earmarks and various stages of the same enthusiasm in others with sympathetic understanding. The high exhilaration of a youngster's "puppy-love" seems to be made of the same elements which the new addict to flying finds in the early thrill of getting off the ground.

An analysis of the human frailties which make up these emotions is a job for the psychologist but it can be easily recognized that the affliction of puppy-love and that of aviation glamour affects senses more actutely than reasoning.

Almost everybody on enlisting their enthusiasm in aviation is convinced that somewhere in his mind is the one idea that will supply the missing link between the present brave experiment and the universal adoption of airplane travel with its subsequent airplane ownership, true factory production, filled hangars, busy gas-pumps, repair shops and service stations, crowded flying-schools turning out thousands of daring and needed young men to become highly paid executives, hundreds of embryonic Henry Fords, millions of willing investors staking life savings and who soon become more concerned with contriving a labor-saving-automatic coupon-clipper than to the security of their principal. The mob mind—the blind faith—the appeal to fancy, lacking in reason—dreams of hundreds of thousands of airplanes, but, out of the entire chaotic list not one logical *economic* reason for ownership.

The fastest, most economical airplane of today can not be offered to the user with any figures to prove that the purchaser can fly it consistently at a saving over other established means of transportation during a six months period.

Airplanes, aside from the military and subsidized lines, become a contrivance of occasional convenience, a delightful sporting propostion for those who can afford them. Their utility is not comparable with the motor car but is greater and less hampered by seasons than the motor boat. They are about as safe as riding a spirited horse to hounds, yet no more difficult to handle.

Telling this absolute truth about airplanes will tend to gain a confidence now lacking in the industry and will enhance sales only after the debunking process is further advanced.

Some new aviation enthusiast, emerging from the puppy-love period, will advance all the old ideas in their usual order and then crash through with the

D. A. Luscombe

one idea necessary to simplify and clarify the irresistible need to the inherent sporting instinct of every human. This human, of course, must have a little extra money. The Moses, who will lead aviation to the promised land most likely will not be an investment banker nor an engineer, nor will he be handicapped by the fine old traditions of 1929-30 and the heroics and exhibitionism of the barnstorming days.

Until this Messiah appears, we as an industry had better join hands to encourage each prospective customer, not so much to buy any particular type of craft but to sell him on the sheer pleasure of flying for flying's sake. The make of ship a prospect buys is of little consequence so long it fulfills the purpose to which he will wish to put it, and so long as it fits his pocketbook. We may preclude his disappointment if he is made to realize at the outset, that he may make his choice from three general classifications of aircraft as follows: The so-called slow landing, airport type of craft; the fast cross-country expensive type and the fast cross-country economical type.

Thomas A. Morgan

(Continued from page 160) al security; and second, because of the economic aid to the business of the country in the form of more rapid and efficient means of transportation and communication.

Progress made in all branches of aviation during the past several years may be largely attributed to the money that the public invested. This money has been used, some of it wisely and some unwisely. Nethertheless, we may safely attribute whatever progress we have made to the fact that this money was made available by the public. Our technical developments have been paid for by the public. We are rapidly reaching a condition of having expended the sums made available; therefore, it is imperative that the industry, as such, get organized in such a way that progress will continue as a result of profits on the business rather than hoping to reach the end of another rainbow sometime in the future.

Selling aviation by supplying knowledge

By Maj. Thomas G. Lanphier

President, Bird Aircraft Corporation

PRIVATE flying today is being retarded owing to the lack of general knowledge on the part of the public in the safety and economy of flight.

The growing generation looks upon flying as their inherent right and they are inclined to be very impatient with the generation that insists upon keeping one foot on the ground as an insurance against putting the other foot in the grave.

In order to pry that other foot off the ground it becomes necessary to prove beyond any shadow of doubt that one is really safe in flying when proper equipment and competent pilots are used. It is also necessary to prove that any normal person can be taught to fly with much less risk than is taken in breezing along a highway not knowing at what instant some near-sighted, sleepy, intoxicated or just "dumb" driver may alter his course to supply a few patients to the local hospital.

People who are familiar with flying under proper conditions know that more safety and unlimited freedom of action is afforded by air travel than is encountered by perambulators on the ground. The problem is to prove to the public that this safety exists. In the final analysis the only sure way to prove this is to get the person into the air or to demonstrate by a flock of statistics that he claims for safety are correct. The timid souls want no proof. And one of the reasons they refuse to get in the air is the willingness on the part of the flying public to stunt. The majority of doubters already believe that people who fly are a little unbalanced. We practically prove their contention by getting up in planes to do things that no sane person would attempt—just to prove that flying is safe. At other times, we make flights under weather conditions which prove conclusively our lack of common sense.

Our own disastrous mistakes can be traced either to stunt flying or bad weather flying, and both these are done at the will of the pilot. Stunt flying with improper equipment is simply foolhardy. Bad weather flying usually takes place something like this: The transport plane with its precious cargo of human lives is cruising along at about 110 m.p.h. Before leaving the last stop, the weather reports indicate that thick weather would probably be encountered before reaching the next scheduled stop. Anxious to keep up his excellent record for completed flights, the district superintendent, after studying the weather reports with the pilot in whom he has the utmost confidence, says, "Well she doesn't look hot but you might as well take a crack at it." The pilot has been up against the same situation many times before and is thoroughly confident of his ability to cope successfully with any weather condition. In the beginning everything is just fine and he reports satisfactory progress every fifteen minutes. With a ceiling of about 2,000 ft. he is able to pick up objects over a mile away, but suddenly he begins to notice that small feathery clouds are scudding along about the tree-tops underneath him. These, if he is an old hand at flying, should warm him that he is either approaching a storm area or a fog bank. He notices that these low hung clouds are rapidly becoming thicker and finally he drops down to their level. Every now and then he flies through one of them. Gradually, he goes lower and lower and the clouds become thicker and thicker, while his ability to pick up distant objects becomes increasingly difficult. He remembers that not far ahead there are hills which reach up to over 12,000 ft. above sea level in many places. Now, if the old head is working properly he decides to turn back to the last field over which he has passed and land to make a further check on the weather ahead. Most pilots do that very thing and the public never hears of it, but occasionally the newspaper headlines say a plane has flown into a hillside with very disastrous results, and as we read we wonder just what transpired in the mind of the brave chap at the controls the last few minutes before the accident.

Maj. Thomas G. Lanphier

It is never necessary to allow oneself to become involved in thick flying weather. There is always a time when the pilot can decide to avoid such conditions. The elimination of the weather hazard in flying, therefore, is always within the power of the pilot. Practically all other hazards connected with flight may be eliminated by conscientious and exhaustive inspection and precaution before flight.

The other stumbling block in getting the public into the air seems to be cost. The uninformed are laboring under the impression that to own and operate an airplane one must be a millionaire. This is flattery, of course, but there are

any number of companies who can prove that planes may be purchased and operated at no more cost today than that required to purchase and maintain a medium priced car.

The average gasoline consumption for a 100 to 125-hp. plane of today is about ten miles to the gallon and, contrary to the popular conception, very little oil is used. Stated in terms of the motor car, the average life of a plane is over 200,000 miles. This represents 2,000 hours at a speed of 100 miles. Checking the motor every 10,000 miles and giving it an overhaul every 30,000 usually involves less expense than a similar operation for the motor car after the respective mileages. The average storage charge for airplanes is about $30 per month which again compares favorably with the storage charges for automobiles.

Selling aviation today is a creative business and one must create one's own market. The chief method of building up this market will probably resolve itself into proving that commutation by air is practical even now between thickly populated centers. This is being demonstrated almost daily by most of the established airlines but it has yet to be demonstrated to the extent that the public will fly its own planes.

The solution of selling aviation to the public seems to be obvious to us. Again, to us, flying is the best method of getting from here to there, but does the public agree? How can we make them agree?

William B. Mayo

(Continued from page 160) important of these was the over-production of engines and planes in 1930. This excess of necessity had to be sold before new stocks could be manufactured. This now largely has been accomplished.

Moreover, the air transport operators soon discovered that the planes and engines in service on their lines were depreciating more slowly than had been anticipated. Their normal life was found to be twice as long as the expectancy originally estimated for them.

Ford trimotors in service on the principal airlines are a fair example of this. We originally estimated the expectancy of these planes to be about 2,500 hours of service. Recently, we received a report from one of the principal operators which showed that many of these planes already had been in service in excess of 3,000 hours and that some were approaching the 4,000-hour mark. We rate the expectancy of these planes now at 5,000 hours.

The engines in service on these planes have similar records. At the outset, their expectancy was fixed at 1,500 hours. Many of them, after cylinder replacements, have been in service more than 2,000 hours. Their expectancy is now rated at 2,500 hours and I think the figure is conservative.

For this, the aircraft manufacturers deserve a gool deal of praise. They have demonstrated that no better planes are produced. But the net result is that the air transport operators have been able to postpone replacements to a future date. That was another of the primary reasons for the slump in plane and engine output last year.

Still another factor, of course, was the lack of ready cash for extensions and replacements. There were others. One was the desire of the operators to wait for improvements. Another was the indecision which exists as to what types of planes should be purchased for replacements.

Many companies today are not filling their planes with payloads. Of course, this is the result of the decrease in travel and the economy wave prevalent in business generally. Many operators as yet are unable to determine whether they should continue the operation of larger transports or turn to smaller planes and increase the frequency of service.

We are confident that eventually the decision will have to be in favor of the larger planes because with the return of better business conditions air travel is bound to grow again by leaps and bounds and the larger planes, as well as a greater frequency of service, will be necessary to accommodate the traffic.

It must be remembered that commercial aeronautics—and particularly the operation of scheduled air travel services—is now in a highly interesting stage of transition. We have passed through the initial stage when vast sums of money were poured into the pioneering air transport organizations. These millions have been spent in solving the problems of air transport operation. Sound lessons have been learned, even though they have been costly. It is now possible to travel quickly and safely between the principal cities of the United States on regularly-scheduled well-organized air transport lines.

Commercial air transport today is on the doorstep of another great stage in its development. I am confident that the railroads—their eyes opened by the successful competition of the motor bus —will not again be caught napping. Railroad operators today realize that their business is transportation—not alone the operation of vehicles which ride the rails, but also of vehicles which operate on the highways and in the air as well. It will not be long before the railroads become an effective force in air transport operations.

In still another direction, air transport faces a new era. Thus far most of the air passenger services have been heavily subsidized by mail contracts. But this day is passing. Postmaster General Brown already has told the operators that their rates are too high and must be reduced to a reasonable minimum, only sufficiently greater than rail mail rates to compensate for the saving of time possible by airplane deliveries.

Within three years, therefore, the operators must find a way to put the business of carrying passengers by air on a self-supporting basis. This can be done only by attracting a greatly increased traffic to the airlines.

Perhaps the greatest single factor which has worked to slow up the development of air traffic has been fear. The general traveling public—we will have to be candid about this—still has an instinctive fear of air travel. To be sure, there are thousands of pioneers who are using the scheduled air transport services regularly, but these are only a small minority of the traveling public.

This feeling will die out gradually as time goes on and the public comes to a realization that flying is, in its nature, as safe as any other form of travel. There was a time in the early days of the automobile when the public was afraid to ride in the new contraptions. Motor touring was considered a hazardous venture.

The same change in public sentiment is coming in aviation. I even venture to predict that eventually all first class passenger traffic as well as the first class mails will travel by air. History shows that these classes of traffic always move by the fastest means. It was true when the steamship displaced the windjammer, when the canal boat supplanted the stagecoach and was in turn superseded by the railroad train.

This change will come gradually. Men will be converted slowly to air travel. Eventually, however, they will become as accustomed to flying as they now are to travel in high-speed railroad trains, buses or automobiles.

This change can be speeded up to some extent, I am sure, if the industry devotes itself to its one outstanding problem—selling transportation by air. We must convince the public of the essential safety of flying. Air travel even now is comfortable. But the traveler who is willing to pay for de luxe service demands the utmost in comfort and there are many things which can be done to increase the comfort of air travel.

Our air terminals must be made more accessible. We must make it just as easy to get to the airport to catch the next plane for New York as it is for us to reach the railroad terminal. The time required in traveling to and from airports must be reduced to the minimum.

The convenience, the economy, the practicability and the very romance of travel by air must be impressed upon the public. Obviously, we have a tremendous selling job ahead and this job must be done within the next three

years, if our transport lines are to become self-reliant and able to carry on with government mail rates reduced to a minimum.

B. D. DeWeese

(Continued from page 161) permit existence in times of stress and these same factors will make for success when 1932 gets going.

All manufacturers, who must depend on these operators and pilots, should now take group and individual action to stimulate public patronage of the services offered by the flying field and its personnel throughout the nation.

All of us have likely been guilty of stressing the sale of our particular make of plane to the exclusion of all other activities. We must then, readjust our sights and put our shoulders to the task of helping revive flying field activities as the group effort of these thousands of men will do more to increase flying among private owners than all other forces combined.

The water is fairly well squeezed out of this entire industry and it is in better shape to earn profits and thus attract capital and brains than at any previous time in history.

These men who have weathered 1929-30-31 out there on the front line deserve a big measure of credit and they are certain to be paid in dollars for the faith and courage which enabled them to "get through regardless" as 1932 will see the beginning of a new era in the progress of aviation and these pioneers will be reimbursed in direct proportion to their ability to size up the new order of things and push ahead in the right direction with new enthusiasm.

Helping these men, then, is the most vitally important thing in correcting "What's Wrong with the Airplane Business."

P. G. Johnson

(Continued from page 160) able adjunct to other forms of transportation. They have a right to expect that every known safeguard which can be thrown around air transportation shall be used. They have a right to demand that they shall not be carried in weather which is doubtful. These observations are made to emphasize that the first point in selling air transportation is for the air transport companies themselves to make the first order of business the throwing of every safeguard around flying, even if it costs more to operate under those conditions.

It will be a happy day for our industry when no one in it regards the airplane as a hippodrome affair and when every member of the industry fights against the spectacular. It is probably true that a portion of the press has given over-emphasis and over-dramatization to airplane accidents, but the number of these accidents can be sharply curtailed if and when every one in the industry puts it on the level of a necessary and growing method of communication and transportation. Aviation has suffered from too much romance, too much of the gold rush days, and too much of the spectacular.

Second consideration is that the industry should not be too hurried in its endeavor to put people into the air. Commercially, aviation is only six years old. The airplane is the first instrument of transportation which requires people to get off the ground, and for that reason there is more resistance to it than has been encountered by previous forms of transportation, such as the train, steamboat, and more recently, the automobile. Each of those forms of transportation had to bide its time until the public, digesting what it saw and heard about that particular instrument of transportation, concluded it was a form it should utilize.

Furthermore, it has not been until recently that the air transport lines of the United States had the type of planes, the ground facilities, depot hangars and other facilities to offer the public. Now, with the growing recognition in the industry that the airplane must survive by giving good service at a fair price, coupled with a growing appreciation of the public about the merits of the airplane, there are definite sales methods which can be used in the solicitation of air travel.

In my opinion, air travel is not going to be sold by high pressure, or glossy sales talks, but on the record of air transportation and along the lines other forms of transportation sell their services. The steamship and rail lines have been engaged in the business of selling transportation for years. There are certain well-defined methods of solicitation developed. It is highly probable that when the history of aviation is written five years from now it will be seen that the most successful companies are those which, during this pioneer period, are willing to spend the necessary money to provide the type of facilities and the safeguards required, along with a sane, yet aggressive, program of solicitation developed largely along the lines of those employed by older forms.

G. M. Bellanca

(Continued from page 161) conscious as it should be, is sufficient to keep the majority of the people away from flying.

The number persuaded that flying is safe is not more than 10 or 15 per cent of the population, and out of that number we are depending for our sales upon those who have a real need and sufficient means to utilize aircraft. Our problem is to get 100 per cent of the population air safety-conscious, so that out of this total we will have a greatly enlarged market.

At present, airplanes have reached a state of development wherein their safety can be carefully planned and achieved, and are awaiting the public's unhampered fulfillment of its desire to use them. The reticence people have about admitting their fear of flying indicates that down deep there lies a real desire to use this most efficient of all means of travel, the sense of fear being a remnant of the not far past age when all proclaimed that "man can never fly" and the assurance of scientists of the same day that "human flight is impossible." Our present-day planes are sufficiently sturdy and trustworthy to be utilized to a much greater extent, the public's own fear complex being the main retarding feature.

It is true that to increase the quality and safety of airplanes we have to increase the price, and that the number of purchasers of higher priced airplanes is never going to be exceptionally large. However, when, by improving on planes and their safety, we are able to sell to the majority who can afford such machines, sufficient volume will come so that the lowering of the price can be accomplished. Once this cycle is inaugurated on a sound basis, a still greater market will be embraced; the larger number of planes being sold, still greater production will be required, justifying still further price reductions, and the process repeated until an almost unforeseen volume of business is established.

Large production in the aircraft industry will come first by increased quality and reducing the price afterward as volume mounts, and not by the idea of cheap production and selling price, with a consequent sacrifice of quality and safety. Once this principle is placed in operation, various new uses of aircraft will appear automatically, opening up larger and larger fields of prospective purchasers. The usefulness of aircraft is too great to be throttled for long by a fear-complex founded rather upon instinct, than upon reasoning and accurately compiled data.

Most persons who have given the matter serious thought concur in the belief that, although the aircraft industry will not develop into real volume production as far as, for instance, the automobile or radio industries, due to the inertia of the public in persuading itself to change from the centuries old means of land and water transportation, the day is not far distant when the general use of aircraft as a mode of transportation will be very popular.

We also know that the public wants speed and still more speed in its transportation systems, but *safety* comes first. Let us give the public all the speed we can, but with *safety*, and never sacrifice *safety* to obtain speed.

It is always refreshing and sometimes profitable to stray from the beaten path of conventional development in an industrial field and to visualize a future product. Such exercises are particularly valuable if one looks ahead without losing sight of the fundamental economics of the situation. In this type of analysis, and in the application of popular psychology to the development of the products of industry, Mr. Stout is a past master. Despite his projections into the future, he never forgets his oft-repeated slogan that "A commercial airplane is a plane that will support itself in the air financially as well as mechanically."

Planes of yesterday

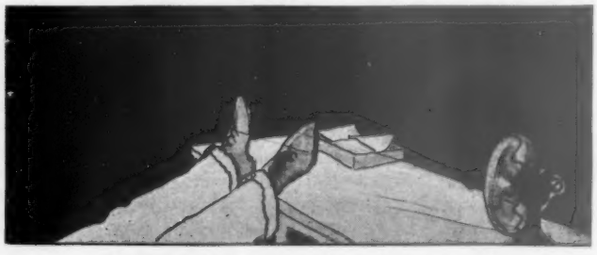
By William B. Stout

ILLUSTRATIONS BY THE AUTHOR

Oh where are the planes of Yesterday?
The wind has blown them all away!
Or is it that they couldn't pay?
Oh where are the planes of Yesterday?

THAT'S poetry, if it is somewhat Villonous.

It has rhyme and reason, and the proper number of feet with the usual Oxfordian environment, and anybody'd know that it was poetry. It has something reminiscent in it, a reminder of something you have heard before—a sort of paraphrasing of something good that someone else has done sometime that we take and make over and call it new. That is the way with amateur poets who do not know enough about the business of poetry. They can't create—so they copy—which is by way of admitting that I profess to be no poet.



One man who knows his job is better than the best committee of experts that ever slept around the same council table. More good airplanes have been ruined by a board of engineers than by stock brokers.

And if this is so with poets so it is with other authors and inventors, or even—if I may be pardoned—airplane designers and business men (?).

The airplane industry, or business, or racket—take your own definition depending on which branch you are in—offers more opportunity right now that it ever has or that any industry has since the beginnings of transportation.

However!

There was a man who built a house upon the sand. And the rains descended and the floods came and the winds blew and beat upon that house and it is still there, and will be till Hell freezes over; because the man that built it had brains enough to know what he was doing. Costs too much to build a house upon a rock.

But this man was a Prodigal Son, so prodigal that he refused to be standardized by his community, or his parents or his times, and instead of telling them all to go to Hell, he let them think that *he* was going there; while he went out and did the world's constructive work and learned to build solid foundations for basic structures in industry, on foundations shifting as sand, and quite as treacherous. The fatted calves stayed home—and they are still there.

There was once a bearded prophet, gaunt and ill of frame, who stood in the market place and cried aloud:— "Woe is me and my generation. Woe unto my business which the Lord hath taken away from me!"

No one was able to explain how it was the Deity had taken away this man's goods when he himself had acted such an ass in order to get where he was—but still he sobbed, "Woe is me!" Since he started hollering there has been no prophet in his business other than himself.

There was a man who said that paint could not be made to dry quickly. A man who did not know this—for he didn't know the expert—went ahead and made some that would; which cost the first man 4,000,000 simoleons within two years.

A group that knew all about clocks from 200 years experience turned down the inventor of the electric clock. Now he tells *them* how clocks are made—and cares not how they were made in Caesar's time.

A group of pilots, colonels and bankers, having learned all about aircraft from a flat-topped desk and an electric fan, built just the right kind of an airplane the way planes should be built.

Their warehouses are full of them.

One can have any of them now for the singing of a song—let us suggest the "St. Louis Blues," or "Only God can Make a Tree—into an Airplane."

Some of the engineers will be glad to play an accompaniment on a slide rule.

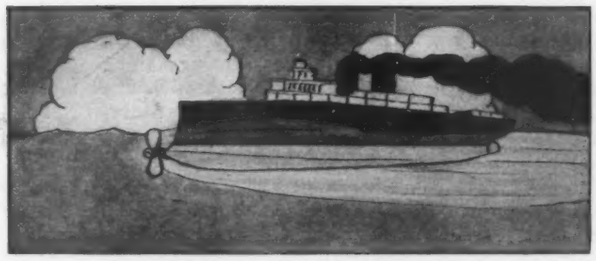
This all boils down to a lot of precipitated facts which have left the airplane industry out as punishment for a lot of un-thought-out plans, half-heartedly carried out, and with two eyes on the stock market and not half an eye on the main issue.

True,—that is all water over the dam—but unless we look at our mistakes enough to know where we failed we can't wail at the Deity as entirely at

fault for our own ailment —nor is there a Santa Claus to give us something we don't ourselves create from the material put into our hands.

Frankly, the old type plane has failed.

Big planes are too expensive and can't earn a profit. Little planes are too complicated and flimsy and have not the slightest appeal to the public that want to fly—and there are plenty of people who do.



What would you think if the designer of a ship put the propeller in front to blow all the water back over the hull to impede its own progress?

The prospect who comes to your factory is a "trade-my-model-T-for-a-first-payment" type. He has no money, and no brains or he wouldn't be approaching you on a cheap basis. Even if you had what he wants—or rather what he thinks he wants—you would still have no market; for this one has no money and wants to take it out in trade. He is enthusiastic and willing to carry water for the elephant but he knows nothing even of white elephants.

Let the industry first learn that the *cheap* market is not big enough to waste your effort on, and a step will be made.

By this I do not mean the low-priced market which is vastly different than just cheapness; but low price and quality can only be had by volume of sales resulting from volume of demand.

You know what the salaried public that could really afford a plane wants, but because you do not look him up you don't know where he exists. Instead we have listened to the half-baked thrill enthusiast who wants to be a Lindbergh and get his name in the papers who comes around and offers unlimited and equally worthless advice in endless repetition.

Planes must appeal to people.

They must attract the market that is able to buy and maintain.

They must satisfy the women—or they won't let the men fly.

The age of flying contraptions is over.

If we have the courage as an industry to scrap the old type unsightly crates of uncertain materials and certain unsociability; to throw away the discomfort and noise and grease of the flying machine, and produce air vehicles, then and only then can we even interest any quantity of buyers.

What we must have is more psychology of engineering and less hair-splitting of theories; more business men and less bankers; more production of planes and minimum of production of stock.

Too little money to do it with is an advantage, and will keep the plane and the production methods simple.

Too few men, will make smaller committees, and hence more accurate results.

One man who knows his job is better than the best committee of experts that ever slept around the same council table.

More good airplanes have been ruined by a board of engineers than by stock brokers.

Duco did not come from the paint industry. Telechron did not come from the clock industry. Balloon tires did not come from the motor car industry.

That new plane

This new plane may not come from the old airplane industry. It looks as though a certain motor car man with youth and most certain brains might know so little about what the experts say, that he might show us all how.

Somebody better tell him it can't be done before he goes and does it and spoils all our set ideas.

What then can we do? What is wrong?

What would you think of a steamship builder who would propose to build a ship for a transportation company that did not have capacity nor speed enough to even approach a dividend? (How about that air transport?)

What would you think if the designer of a ship put the propeller in front to blow all the water back over the hull to impede its own progress?

What would you say of a bicycle manufacturer starting to build high bicycles since safety's can be had.

What would you say of Gar Wood if he put his motors out in the water instead of inside the hull?

What if Ford started covering cars with doped cloth and put on pyralin windows, and left off the muffler, etc., etc., etc.—(See the specifications of any private owner cheap plane,— and many not so cheap.)

Note: This article was written at the request of the editor, with the specific intention that it should stir up the most constructive discussion possible, to the end that we may find some way out of the impasse we are now facing with the old type airplanes.

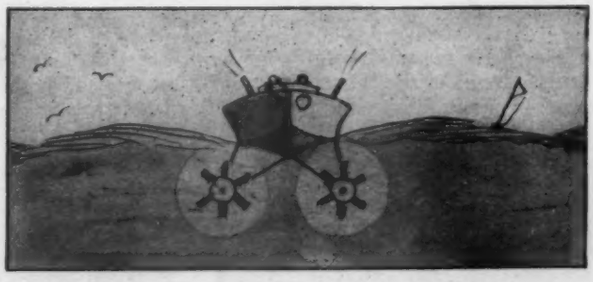
The commercial and transport airplane business still awaits an airplane which can earn a dividend. So far as the private owner is concerned, the dealer still awaits an airplane which can be sold.

In the transport field there is but one answer, and that is the building of a commercial airplane on the definition I gave years ago when we built the first Liberty-engined transport for our first passenger service; and that is that *"a commercial airplane is a plane that will support itself in the air financially as well as mechanically."*

We know now how to make such a plane and within the next two years they will be in the air in quantities from several sources, but we do not as yet know what is the final requirement so far as the private owner is concerned.

We have built scores of ships with idea that what the public wanted was a cheap plane. The result has been a "cheap" plane with a sales cost so high as to make it far more expensive than our former expensive planes. Why cannot our near executives in the airplane business take a lesson from previous industries and get over thinking that the American public is fool enough to buy a shoddy product. What private-

What would you say of a bicycle manufacturer starting to build high bicycles since safety's can be had?



What would you say of Gar Wood if he put his motors out in the water instead of inside the hull?

owner airplane is there anywhere that you would pay your own money to buy, no matter how much money you had? Where is the plane you want your daughters and wives and sons to learn to fly in? The answer is—Where?

We could make a cheap automobile to sell for a hundred dollars sans fenders, sans muffler, sans cushions, sans comfort, built up of sticks covered with cloth and paint, and fitted with pyralin windows and wire controls. This would be very cheap to build but who would be fool enough to buy one. People know quality; they know strength; they know materials and workmanship and they know appearance, and we have been building the type of planes that nobody but a damn fool would buy and because they did not sell, have said that there was no airplane business.

Your prospect is the man who has money enough, not only to buy, but to support an airplane.

He is the man who can judge, or he would not have made this money. He is interested perhaps in seeing some unthinking youngster do his stuff in some of this equipment, but he is not interested in riding and certainly not interested in buying. If he would buy, it would be in spite of the opposition of his wife, who, after all, is the one who is going to say whether John Public flies or not. Until we build a plane that the wives look at and say, "You can fly, in that and I will go with you," we have nothing to market.

Volume needed

Until there is appeal enough in this machine as a vehicle—not as a thrill—for a large public to buy, it will never be low priced.

The only way you will ever get quality and low price is through volume, coupled with extreme ingenuity of the simplest possible engineering. This precludes the use of all gadgets, "flops and slats" and the elimination of a large measure of adroitness necessary for safety in the old type plane.

Let's consider the woman as our prospect, because she is the one we eventually must sell even if her husband is the one who buys it and uses it.

The first fundamental of this salesmanship is looks.

The plane must appeal to the eye, not only from the standpoint of beauty and authority of line and relations of areas, but from the obviousness of the mechanical features which give it the new safety. Some of the things that can be done to induce this feeling are: (a) It should stand on the ground horizontally instead of at a slant. (b) It should be reminiscent of a motor car or bus. (c) It should have upholstery or trim so that one repeats some previous feeling of transportation security when they sit in the cabin.

Any feature which can be visualized in the design to show how their operation brings greater safety, have an added appeal.

Aside from appearance, the next thing—and it is just as important—is the elimination of noise. This is a tremendous job to get rid of the noise of a power plant so close to you, and to also eliminate any mechanical feeling when one sits in the ship. Nowadays you look forward through the propeller and rocker arms with oil coming back on the wind-shield and from all appearances seems like riding in the midst of a machine-made cyclone, with a resultant terror.

The machinery

Propellers would be better if not at all visible, and engines and power plants out of sight so that there would be the real feeling of a vehicle and not an airplane. A lot of other things could be done also to make the private owner more interested in the things we want him to buy and fly.

Number one is perhaps simplicity of control. There is no reason why we cannot take from him any necessity for the use of the rudder in the air, all steering, as well as banking, being accomplished with the ailerons. This has been accomplished already in at least one ship I know of.

This might even allow the use of a wheel like in an automobile and which would be used the same way, except for its fore-and-aft action for elevator.

Of course with his arrangement it would be impossible to side-slip the plane, but this is not necessary provided complete controlability in a stall can be given to enable one to pancake down from considerable height against a long travel oleo and air wheels arranged on the center of gravity of the vehicle to let it onto the ground like a bird. These things are coming fast and can be accomplished within the next year by anyone who really wants to do them. Personally, I believe that the old "high-bicycle type" of landing gear is through, so far as private-owner is concerned. Wheels up front in the old type ship were useless anyway on account of the landing angle required for the plane to stand on high stilts with proper propeller clearance.

When you put on the third wheel in front with a ship designed to take it, and with the added idea that the lift is taken from off the wings when the front wheel is on the ground; you then have a plane which can be flown in to the ground at higher than landing speed without danger of its taking off again; thus adding considerable to the safety of the amateur pilot in his first few hours of landing.

Personally, I am convinced that the open type plane has no possibility.

No woman of any position is going to travel around wearing "trick" clothes and land at strange airports to visit her friends all togged out like a circus clown. The private owner must be able to travel in the same costume and in greater luxury than in his high-class motor car with nothing to disturb him.

The kid days of wearing a helmet to show off the super-man are over so far as the public is concerned. Let's get over thinking we are a bunch of heroes and try and convince somebody that at least some one person in the airplane industry is a business man and not just a pilot or a brainless enthusiast.

Again, let us remember that military aviation with its very definite and praise-worthy requirements has absolutely nothing in common with the private-owner vehicle other than engineering. The requirements of the private owner are of an entirely different class than those of air defense units. More than that, commercial aviation can bring just as many new viewpoints to military aviation and its engineering as military has brought to commercial—and that is a great deal—for which full credit is and should be given.

A hundred a day

There are those, of course, who will disagree with what I say here and say that tandem-seater open planes where conversation is impossible are good training planes and can be sold. Of course they can, two or three a day, but until we get a production of a hundred a day we cannot call this an industry in any sense of the word. Where is the ship that can sell in quantities of a hundred a day. Nobody has it so far as we know. Nobody has conceived it but it is time somebody worked pretty definitely on it that we may get somewhere with the private owner.

We have been playing around the edges of business running a "fresh air-taxi service" with "corpolations" and "silent vice presidents" and "big meetings," but we haven't even a lunch room paying a dividend.

But after all of this is said—it is not basically a negative picture. There is an opportunity for the industry now that it has never had before. The banker, with his financial influence is not forcing us to design ships that we know will not pay a dividend even if they are perfect as engineering jobs. The broker has gone broke and we don't have to design something quick to satisfy a lot of supposedly critical stockholders.

We have enough money to create ideas with and if we build with too little that is but a small handicap more than overcome in many cases by the advantages of more direct results.

Here is the opportunity for new groups, for new engineers, for new initiatives—with the inventor more and more out—he is just a purveyor of opinions—and the engineer who works on facts sitting in the saddle. This is still the problem of the engineer, so let's go to it.

Payloads, performance, and safety

The autogiro answers its critics

By Harold F. Pitcairn

President, Autogiro Company of America

WE ARE pleased to have AVIATION give us the opportunity to answer publicly questions that are frequently being asked about the autogiro.

We believe that much of the criticism of the autogiro comes from an erroneous point of view. For instance, many of the industry feel that the only criterion of the airplane is how fast it will go and how much weight it will carry for a given horsepower. If this were the whole story the airplane industry would be immeasurably larger than it is today. The autogiro overcomes most of the limitations inherent in the airplane and the qualities in which it is inferior to the airplane at the present time are grossly exaggerated by its critics. Also the autogiro is in the early stages of its development whereas the airplane has already reached the point where it would seem that further improvement can come only from modification and refinement of comparatively small details.

I would like to analyze here the comparisons that are frequently made between the airplane and the autogiro. In the first place, there are very few types of autogiros on the market, but many types of airplanes. We find specific types of airplanes with all kinds of performances, but we do not find a single airplane with the best performance in every respect. The average airplane falls far below the fastest airplane in speed, although it may meet the requirements of the private owner more adequately. The average airplane may more nearly fill the needs of many than the airplane which carries the greatest load per hp. Aircraft should be considered from the standpoint of the purpose for which they are built, for even now the autogiro is superior in speed and payload per horsepower to certain airplanes, notable among which, in general, are amphibions.

It would seem useful here to explain what I mean when I use the term "vertical descent" in answering the questions presented by the editor of AVIATION. A machine which is properly designed will have the center of gravity placed slightly in front of the center of lift. This will at all times ensure the ability of the pilot to drop the nose of the machine by pushing forward the

Genuinely new products are likely to be the occasion of a great amount of discussion. Some comics under the head of report of experience, some of pure rumor. The autogiro has been no exception. Since the type came into more or less extended use, it has been carefully watched by the aeronautical world, and it has been the subject of all sorts of stories, criticism, and charges. We are immensely pleased that Mr. Pitcairn and the Autogiro Company of America have elected to use AVIATION as the vehicle for their first public discussion of all these allegations. ¶ To make sure that they would be fully covered, the editor of AVIATION drafted a set of questions, making them as pointed as possible. Mr. Pitcairn took the questions exactly as written and replied at length to each one, incidentally revealing some hitherto unpublished facts. The questions were drafted by the editor without consultation of the Autogiro Company, and replies were drafted by Mr. Pitcairn without consultation of the editor. Without modification in essential content of either one in any of their parts, both questions and answers are reported herewith.

control stick. It also will mean that absolute vertical descent cannot be maintained in no wind, but this involves no disadvantage.

Question 1: It is frequently alleged that the characteristics of the autogiro are the result of light wing loading rather than of any inherent virtue of the type, and that it has the bad as well as the good features of a lightly loaded airplane. Specifically, it is often claimed that the autogiro can do nothing that could not be done by an airplane of like carrying capacity and maximum speed, except for its ability to land without run instead of taking a run of 100 ft. or so after touching the ground. Have you any data or can you make any comment, bearing specifically on this comparison?

THE manner in which this question is asked would minimize in the mind of the reader the importance of the features of vertical descent and no roll after landing. But these features are essential to a satisfactory heavier-than-air craft. Airplanes are not capable of taking a run of only 100 ft. after landing, except under very abnormal circumstances, and it is generally recognized that the average airplane runs several hundred feet before coming to a stop. On the other hand, no autogiro in the hands of an experienced autogiro pilot need run more than its own length, even when there is no wind.

In addition to its ability to land, without run, after touching the ground, the autogiro is free from the dangerous tail-spin and stall, which allows even the lightly loaded airplane to fall through with immeasurably greater speed than an autogiro in vertical descent and has caused many fatal airplane accidents. Also the ability to descend vertically with the autogiro enables the skilled pilot to land without the slightest damage to the machine in places impossible for any airplane to land and allows the inexperienced autogiro pilot to land in similar spaces in case of emergencies without injury to himself.

The autogiro also is capable of leaving the ground after a shorter run and of climbing and maneuvering sharply at slower forward speeds than even a lightly loaded airplane, and may enjoy these maneuvers close to the ground without fear of burbling. These features greatly reduce the autogiro's risk in comparison with that of the airplane.

Wide World

The innumerable demonstrations given by competent autogiro pilots of the autogiro characteristics are so outstanding that many people who have seen the autogiro for the first time say that it reminds them of the farmer who, after seeing the giraffe at the zoo said, "There ain't no such animal."

There is one respect in which the autogiro is opposite to the lightly loaded airplane. So far as the air bumps are concerned, the autogiro has characteristics superior even to the most heavily loaded airplane. Loading runs anywhere from 30 to 60 lb. per sq.ft. of blade area. Combined with the hinging of the blades, this feature renders the machine much less sensitive to air bumps than even the most heavily loaded airplane. While an airplane pilot who has flown an autogiro only a few times may experience difficulty in landing the machine in high winds, the pilot who has learned the technique of the autogiro will find that in this respect it is also superior to the airplane.

Question 2: I often hear the autogiro very harshly criticised as having an impossibly low cruising speed. Although it has been generally understood that the higher-powered autogiros reach speeds of well over a 100 m.p.h. I frequently encounter very circumstantial statements that some autogiro now in service is unable to do more than 80 or thereabout. It has even been widely reported that careful records on the travels of a certain autogiro owned by a large corporation showed an average cruising speed of only 52 m.p.h. Can you give us any information, preferably based not only on flight tests but on miscellaneous operating experience, on that point?

THE 300-hp. commercial autogiros clock over a measured course between 120 and 124 m.p.h. The 125-hp. Kinner commercial autogiro cruises a comfortable 80 m.p.h. when throttled 250 r.p.m. under maximum. If a pilot of an autogiro chooses to throttle back his motor and cruise at 52 m.p.h., or even slower, he is at liberty to do so but this is a feature peculiar to, rather than a criticism of the autogiro. It should also be pointed out that no particular attention has been given to maximum speed possibilities in the design of the autogiros in this country. Present-day autogiros have much unnecessary parasite area, as did early airplanes. According to the theory upon which autogiros are now designed, they will be as fast as the airplane when their parasite is the same.

Speed should be considered from the standpoint of how long it takes one to go from where one is, to where one wants to go. Autogiros can land on many private estates so that one can go, say, from his country home in the vicinity of Philadelphia to Washington in the same or less time in the autogiro than he can in the airplane because he will save the time required to motor to the flying field. Also landing on piers with the autogiro is practical, as was recently demonstrated. So if the matter be viewed in a broad way, even now, time can be saved over the airplane with present-day autogiros in many instances.

Question 3: There is a great deal of skepticism about the ability of the autogiro to handle heavy loads. Of course, there is general knowledge of the demonstration given by Mr. Ray at the engineering conference at Langley Field last May, when he handled a dead load of 1,000 lb. with apparent ease. Still it is pointed out that the total useful load even on that occasion was less than 5 lb. per hp. and the suspicion is often voiced that the handling of the machine in such conditions would be exceptionally difficult, and only within the capacity of a past master like Mr. Ray. Can the autogiro be adapted to regular operation with useful loads substantially larger than is the regular practice with the models of autogiros with which the public is most familiar?

ALTHOUGH the present-day commercial autogiros have not been designed for the purpose of carrying heavy loads, they are not inferior to some airplanes which have been designed for specific purposes. Loading the machine down with an extra load as was done at Langley Field only slightly increases the difficulty of handling. There is no question but that there will be an improvement in the carrying capacity per hp. of autogiros. The general trend, however, will continue to provide for lighter loads per hp. than in airplane design, to enable the autogiro to approach helicopter take-off. If an autogiro is to be used on airplane fields, even the smallest, it will be practical to carry quite considerable loads per hp., but if its full utility is to be taken advantage of it will be designed with the ability to climb out of fields unthinkable for airplane operation.

Question 4: One constantly hears tales of autogiro crashes of various sorts, and while I appreciate that none of them has had fatal results, their occurrence has been somewhat disconcerting. How are we to account for them in a type of aircraft which has been widely welcomed as bringing flying more easily within the reach of the ordinary man than ever before?

RUMORS of serious accidents (that have no foundation) even to causing death to occupants, have been started apparently maliciously. It is true that there have been quite a few accidents involving broken blades, but in all of the hundreds of thousands of miles of American autogiro flying no blade has broken in the air. The point that is uppermost in our minds is which is most important—safety for the craft or for the personnel? I do not believe that the airplane manufacturer would welcome a comparison of accidents with the autogiro, particularly if serious personal injury and fatalities among private owners were to be included. Although autogiros have been damaged, none has been a wash-out and, with the exception of one machine that caught fire

on the ground from an engine backfire in starting, every commercial and privately owned machine that has been in an accident has been repaired and is flying again. A very important point in this discussion is that pilots who have acquired the technique of flying the autogiro are not having accidents, and the time to acquire this technique is less than is required to become a fully competent airplane pilot.

Question 5: Upon that point, the explanation frequently given by airplane pilots is that the operation of the autogiro actually requires great skill, and is much more difficult than the flying of an airplane. They immensely admire the demonstrations given by the pilots of the Autogiro Company and its licensees, but they are disposed to maintain that these demonstrations are pure stunts, requiring as much skill and delicacy as are needed for airplane acrobatics in close formation. Is it possible to give any record or experience on this point?

IT IS natural that one who has spent a great amount of time in becoming proficient on the airplane would find the operation of the airplane easier than his first flights in the autogiro. For instance, Esperanto is a much simpler language than English, but we find English easier because it is our language. However, the man starting fresh would find Esperanto much easier, and also a man with no previous experience finds the autogiro not only easier to fly but much safer. It is true that the many spectacular stunts that the autogiro is capable of doing require as much skill as flying an airplane, but there is no reason why the novice, or the man inexperienced with the autogiro, should complain that he has not the skill from the start that the expert has acquired with training. At the same time, the novice is capable of making the autogiro do many things that he could not dream of doing with the airplane. The comparison should not be made between the expert airplane pilot and the novice autogiro pilot. Scores of airplane pilots have flown the autogiro with only verbal instruction, and I am sure that all honest airplane pilots would agree that it would be very much more hazardous for a trained autogiro pilot to fly an airplane for the first time with only verbal instruction. After all, broken blades are better than broken heads.

Question 6: Still in this same connection, it is often pointed out that all of the flying of autogiros is being done by men who had a highly developed skill as airplane pilots, that very few beginners have been trained on the autogiro and that there has been no detailed public announcement of the amount of training that is likely to be required by a novice, or of the success attained by particular novices in learning to fly the autogiro without having had previous experience in the air. Can you enlarge on this point?

SO FAR, sixteen men have been instructed on autogiros who have had no previous flying training. In spite of the fact that instruction is necessary to handle the rotor, these men required only from 50 to 75 per cent of the time for instruction before soloing that they would have been expected to take if they had been training on airplanes. There have been quite a few other men who are now flying autogiros who have had only a small amount of previous experience in flying airplanes. It is true that a high degree of skill is required for some types of demonstrating work that has been done with the autogiro. The flying which is most difficult and most likely to result in breakage is that spectacular type in which the pilot is expected to show off and crowd his luck. Much of this has been done by skilled flyers, but this is a specific type of flying and need not be indulged in by the novice.

Question 7: It is commonly reported that most of the autogiro crashes have been due to the pilot making a vertical or a near-vertical descent, finding at the last minute that he was drifting across wind or going to land in an unsatisfactory spot, and opening the throttle, with the result that the torque took charge and rolled the machine over so that it struck on the tips of the rotor. Is it necessary to regard this as a very serious problem?

THERE is no reason why the novice should indulge in vertical descent close to the ground. A small amount of forward speed gives him ample control for any situation and allows him to descend much steeper than an airplane. The ailerons will overcome the torque of the engine with some throttle even while near vertical descent, and will adequately compensate for full throttle at speeds well below the airplane's minimum.

Question 8: Another special kind of sensitiveness with which the autogiro is frequently charged by its critics is sensitiveness to balance. It is rumored that an accurate handling of the machine, and especially such displays as Mr. Ray and others have habitually given, requires an extremely delicate adjustment of the center of gravity, even a shift of half an inch in its position having a pronounced effect. Does experience offer enough evidence to speak positively on that matter?

OF COURSE, correct balance is necessary if one is to get the utmost out of the autogiro. On the other hand, the 300-hp. commercial autogiro can be flown with as much as 300 lb. of lead placed in front of the firewall. An autogiro can be landed safely when out of balance just as readily as an airplane can. In both cases there must be sufficient speed to maintain active control, and the speed required for this with an autogiro is much less than in the case of an airplane. It is not generally known that ballast for certain commercial airplanes now in use is also necessary. When flying light, with quite a few transports, it is essential to carry

extra weight in the tail to avoid the risk of nosing over while landing, if the machine is brought in at its minimum speed, which in no sense approaches vertical descent even in normal wind. The only difference is that the autogiro gains more than the airplane by having correct balance.

Question 9: The autogiro is often spoken of as permitting vertical landings. On the other hand, many of the upholders of the airplane who have seen it fly claim it is unable to land vertically from any considerable altitude and that landings without roll can be made only against a gentle wind or by the exercise of special skill in nosing down and then pulling up a few feet off the ground to check the descent gently. I have heard estimates of the minimum forward air speed of the autogiro for landing without change of course at the last moment ranging from 5 to 25 m.p.h. Can you shed some light on the vertical landing capacity?

IN THE first place, I have never seen any airplane land vertically in any kind of wind. All present autogiros with a good autogiro pilot, can land vertically from any altitude if there is some breeze. Vertical landings can also be made with the autogiro in no wind. We have done it quite a few times from considerable heights without any damage to the machine. However, in this case the landing is hard enough to reserve the maneuver for emergencies, in which case there should be no question about doing it, for the rate of vertical descent is, as has been demonstrated a number of times, slower than that of a man in a parachute. The unskilled pilot can also land vertically, but with risk to the machine. The main point in favor of the autogiro's vertical descent, however, is the absence of danger of tail spin. In any condition it can descend so very much more steeply than the airplane that its advantage in this respect is too obvious to spend time to comment upon. While an airplane is making its steepest descent, it is always on the verge of a spin. This is never true of the autogiro. To land gently, some amount of forward speed is necessary, but we cannot see that this is a reasonable objection, especially when compared with airplane characteristics.

Question 10: Referring again to vertical descent and to the claim that is made that that is not a really practicable maneuver for the ordinary user, I hear it said that there is a complete loss of aerodynamic control in such a descent and that the machine can neither be headed in the desired direction nor restored to an even keel if it strikes turbulent air. Is there foundation for this?

A CORRECTLY designed autogiro in vertical descent approaches the condition of a parachute, with all its advantages but with the difference that the autogiro can always regain full use of its controls with a small loss of altitude when the pilot pushes the control stick forward. The machine can be headed in any desired direction even in vertical descent, and is so inherently stable in this condition that turbulent air does not put it far from an even keel.

Question 11: Another of the widespread rumors relative to autogiro crashes is that they show extreme sensitiveness of the machine to the slightest cross-wind at landing. It is commonly declared that an autogiro will roll over, with serious damage to its rotor, as the result of landing even at a very small angle to a very light wind—conditions which would not bother an airplane in the least. What does experience reveal on that score?

THIS is purely a matter of practice, and those who become proficient in handling the autogiros are not tipping over. If the machine is coming in with a drift and brought to a full stop before contacting with the ground, it will be landing sideways and in this case it may tip over. However, the experience required to avoid this is greatly exaggerated by the critics. Autogiros can make side-wind landings, when the wind is not too strong. However, a side-wind landing is not necessary in view of the autogiro's ability to land without run, especially when there is wind.

Question 12: When pilots try to picture the operation of the autogiro under various hypothetical conditions, one of the things that they discuss is the possible stoppage of the rotor, or its slowing down to a dangerous degree, by encountering a peculiar series of atmospheric disturbances in flying through such tremendously bumpy air as is sometimes found in mountainous regions or in thunderstorms. I assume that experience on that heading has as yet been quite limited, but perhaps theory can shed some light.

WHEN Jim Ray landed the autogiro on the White House lawn, weather conditions were favorable. However, a few hours later the weather became very stormy. When he left Washington a small twister was coming out of the Potomac. His oil pressure was becoming low, so he landed at Baltimore. Air conditions were so rough that transport lines had stopped flying, but he continued on to Philadelphia, his destination. While naturally he found the air rough, the rotor behaved itself perfectly and did not show any signs of slowing down. Autogiros have flown in all kinds of rough air, through thunderstorms in the mountains and, in general, under all the meteorological conditions encountered by airplanes. Under such conditions, the rotor smooths out the bumps considerably more than an airplane, and always maintains its normal rotational speed.

Question 13: Another question frequently asked concerns itself with the possibility of recovering from abnormal positions, such as the inverted. Of course the most obvious observation there is that there is no excuse for stunting an autogiro, or for getting it into an inverted attitude, but pilots insist on considering the possibility. Is there real hazard there, or has it been found necessary to impose any particular restriction on the maneuvering of the autogiros that have gone into the hands of the public?

FOR the thousands of hours of autogiro flying in the hands of many pilots, no difficulty of this kind has arisen. We think the danger from this is extremely remote, and experience so far has vindicated our conviction. As a matter of interest, pilot Godfrey W. Dean of Fairchild Aircraft, Ltd., of Canada looped their autogiro on Oct. 13, 1931, at Pitcairn Field .

Question 14: The rotor blades operate within a range limited by the suspension cables, and are normally free at all times in flight. It is often suggested that if the machine were dived at high speed and full aileron were then applied very suddenly it would be possible to roll the fuselage so rapidly that the rotor would not keep up with it, and that the result would be to bring the rotor blades up very sharply against the check cables, with considerable structural danger. Is this an actual possibility?

THIS is not possible. The uninitiated probably consider that the rotor is compelled to follow the fuselage by a force exerted on its hub. This also is not so. When the hub tilts, the relative incidence of the blades to the air is changed so the air itself carries them into the correct position in relation to the fuselage and thus relieves all strain. While actually there is some lag, it is so slight that pilots have not been able to detect any and the rotor very closely follows the position of the fuselage, even when the ailerons are jerked most violently.

Question 15: Another of the conditions not often covered in ordinary pleasure flying but necessarily incident to general commercial work, and especially to transport operation, is the formation of ice. What is likely to happen if ice forms on the rotor blades, materially increasing the weight of the rotor and in some degree unbalancing it?

THE undesirable feature of icing has not been solved either for the airplane or the autogiro, and both must land.

Question 16: Although it is generally realized that the bearings that carry the rotor are very generously proportioned and work under comparatively light loads, still some skeptics shake their heads over dependence on any free-running bearing, talk of the inherent uncertainties of even the best materials, and ask what will happen if the friction on the bearing is much increased by the cracking of a ball, by the entry of grit, or dirt, or simply forgetfulness of lubrication. Is there any special problem there?

IN the first place, the rotor hub bearings are so oversize that failure would seem to be impossible. Nevertheless, the ball bearings are multiple to insure rotation even in case of failure. To provide against even this remote contingency these bearings are mounted so as to permit free rotation of their races in their housings in case of ball or roller failure. The whole assembly is so closely fitted, and so amply packed with the proper grease of proved utmost efficiency, that the hub might be neglected for the normal life of the machine. To offset the possibility of neglect, the quantity of grease provided is literally dozens of times the amount necessary for proper operation. This hub is also sealed to prevent infiltration of grit. In fact the chance of hub failure is much more remote than the failure of an airplane wing spar, or hub failure on automobiles.

The cause of deaths in aircraft seldom arises nowadays from structural failure, but mostly from the inherently unsound flight principle of the airplane.

Question 17: One often hears speculation on what will happen in case the engine fails suddenly, and whether or not any special piloting technique is required to keep the rotor turning properly under those conditions. Also in case of engine failure, it is asked whether the autogiro must descend vertically, thus eliminating the possibility of gliding to a satisfactory landing place?

DURING flight the rotor is in no way connected to the engine. The rotor continues to revolve at substantially the same rotational speed regardless of flight speed, which ranges from top speed down to vertical descent. Engine speed has absolutely no effect upon the rotor's proper functioning.

While the autogiro has the ability to descend vertically, it is also capable of a satisfactory gliding angle with power off. Therefore, while the entire area that the autogiro can glide to in case of engine failure is less than with many airplanes, its capabilities of sitting down in minimum spots is such that its chances of finding a suitable emergency field are immeasurably greater. Since the steep descent of the autogiro is usually demonstrated, its ability to glide forward as an airplane is not always realized by the public.

Engine failure also has no more effect on the controllability and maneuverability of an autogiro than it has on an airplane.

Exhibitors at Detroit

(See key below for location on show's "airways")

Aero Digest, 125-7 Tc; Aeromarine Plane & Motor Co., 105-7 Am; Aeronautical Corp. of America, 40-4 Am; Air Reduction Sales Co., 58-60 Pa; Air Tranport Advertising, Ltd., 112 Un; American Airplane & Engine Co., 50-6 Tc; Amphibions, Inc., 4-8 Ea; Aviation Engineering, 132-4 Un.

Bellanca Aircraft Corp., 97-15 Un; Bendix Aviation Corp., 122-36 Pa; Berry Bros., 121-5 Am; Bird Aircraft Corp., 121-33 Pa; Breeze Corps., Inc., 111-3 Tc.

Champion Spark Plug Co., 109 Am; Cleveland Pneumatic Tool Co., 66-8 Pa; Curtiss-Wright Corp., 21-43 Pa.

Detroit News, 11-3 Lu; Dow Chemical Co., 90-2 Un.

Edo Aircraft Corp., 50 Pa.; Elgin Watch Co., 108 Pa; Engineering & Research Corp., 111 Am; Evans Appliance Co., 137 Am; Ex-Cell-O Aircraft & Tool Corp., 37-43 Am.

Fafnir Bearing Co., 109 Tc.; Fairchild Aviation Corp., 73-9 Un; Ford Motor Co., 150-76 Ca.

General Electric Co., 30-4 Ea; Great Lakes Aircraft Corp., 60-8 Am; Guiberson Diesel Engine Corp., 27-9 Tc.

Haskelite Mfg. Corp., 97 Am; Hill Aircraft Streamliners Co., 114 Un; Hurley Townsend Corp., 64 Pa.

Imperial Brass Mfg. Co., 104 Pa; Irving Air Chute Co., 57 Am.

Kellett Aircraft Corp., 85-91 Un; Kendall Refining Co., 26-8 Pa; Walter Kidde & Co., 110-2 Pa.

Lycoming Mfg. Co., 29-31 Am.

Macwhyte Co., 56 Un; Military (Army) Exhibit 98-16 Tc; Monocoupe Corp., 57-67 Pa.

Nicholas-Beazley Mfg. Co., 15-9 Un & 14-6 Un; Norma-Hoffmann Bearings Corp., 42-4 Un.

Parker Appliances, 103-5 Tc; Pitcairn Aircraft, Inc., 7-19 Pc, 12-20 Pa; Pittsburgh Screw & Bolt Corp., 98-100 Un; Pyle-National Co., 107 Tc.

John A. Roebling's Sons' Co., 135 Am; Roosevelt Field, Inc., 101 Tc.

Shell Petroleum Corp., 23-5 Lu; Skinner Motors, Inc., 62 Pa; Smith Engineering Co., 64-6 Un; Sperry Gyroscope Co., 106 Pa; Standard Oil Co. of Ind., 23-7 Am; Stewart Hartshorn Co., 102 Pa; Stinson Aircraft Corp., 25-37 Pc, 11-9 Am; Switlik Parachute Co., 98-100 Pa.

The Texas Co., 50-2 Un; Thompson Aeronautical Corp., 97-9 Tc; Timken Roller Bearing Co., 99-101 Am.

United Aircraft & Transport Corp., 149-75 Ca; United American Bosch Corp., 131-33 Am.

Waco Aircraft Co., 73-91 Pa; Western Electric Co., 113-5 Am; Western Flying, 37 Tc; Westinghouse Electric & Mfg. Co., 63-7 Am; Wright Aeronautical Corp., 15-9 Pa; Wyman-Gordon Co., 24-6 Ea.

The following exhibitors have not yet been assigned space in the hangar: American Cirrus Engines, Inc., AVIATION, B. G. Corp., Brazil Aircraft Corp., Continental Aircraft Engine Corp., General Tire & Rubber Co., Heath Aircraft Corp., Jacobs Aircraft Engine Co., Kinner Airplane & Motor Co., Metallurgical Laboratories, Inc., Model Airline Ticket Office, Packard Motor Car Co., Pennsylvania Aircraft Syndicate, Rearwin Airplanes, Inc., Sky Specialties Co., Taylor Brothers Aircraft Corp., Warner Aircraft Corp.

Key: Tc—Transcontinental; Am—American; Un—United; Pa—Pan American; Pc—Pacific; Ea—Eastern; Lu—Ludington; Ca—Canadian

Program high spots

(All meetings to be held at the Hotel Statler)

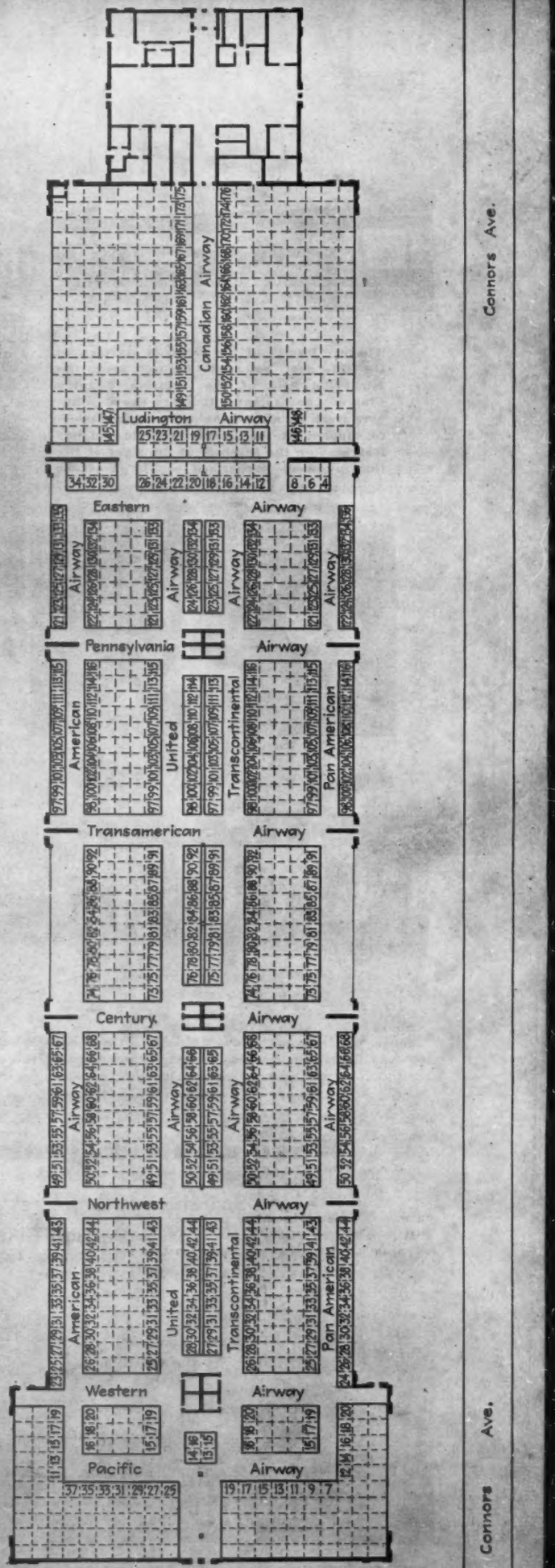
Tuesday, April 5—10 a.m., Aeronautical Chamber with Department of Commerce, "Load Factors"; (evening) S.A.E. Detroit Section Students' Technical Session; Exchange Dinner.

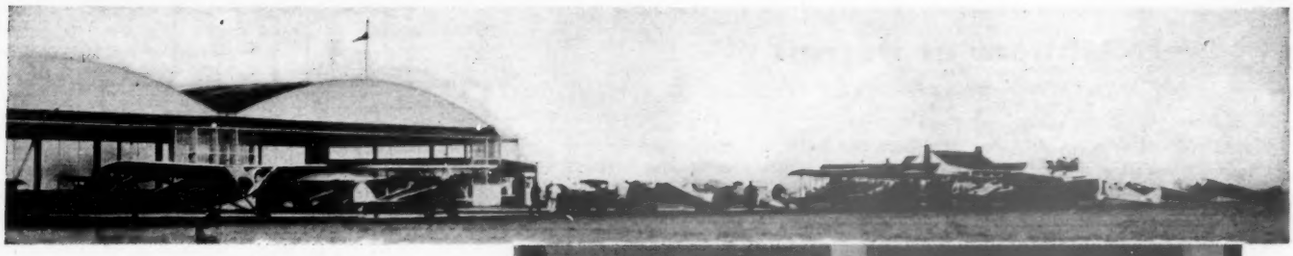
Wednesday, April 6—S.A.E. (morning) "Engineering Aspects of the Autogiro" by A. E. Larsen, "Balance of the Four Cylinder Engine" by C. F. Taylor; (afternoon) "Development Problems of Aircraft Engines of High Specific Output" by R. M. Hazen, "Scavening a Supercharged Spark Ignition Engine Using Fuel Injection" by O. W. Schey; (evening) "Simplified Flight Control" by Ralph Upson, "Aerial Navigation" by Harold Gatty. Quiet Birdmen.

Thursday, April 7—S.A.E., (morning) "Photoelasticity" by D. L. Pellett, "Rational Specifications of Load Factors" by E. P. Warner; (afternoon) "Maintenance Problems" by L. K. Harris; (evening) Joint Dinner Aeronautical Chamber of Commerce, S.A.E., W. B. Stout toastmaster, talk by C. L. Lawrance, presentation of Bendix trophies and Wright medal.

Friday, April 8-10—10 a.m., National Association of State Aviation Officials, address by W. B. Mayo, Roll Call, "Federal and State Laws" by G. B. Logan, "Federal and State Cooperation" by C. M. Young; 12:30 p.m., luncheon; 2:30 p.m., "The States' Responsibility to the Industry" by C. L. Lawrance, "How the State Aeronautical Departments Should Assist the Operators" by Col. L. H. Brittin, "Schools and State Regulation" by Oliver Parks; 4:30 p.m., Board of Governors, N.A.S.A.O.

Unscheduled, meetings of the Aeronautical Chamber of Commerce; Education, Aerial Service Operators, Fuel, Lubricating, and Engine Companies.





Above: Twelve of the eighteen starters on the line just before taking off from the Hicksville field of the Aviation Country Club of Long Island. Below: Cruise numbers were an afterthought—in whitewash—to supplement the private triangle and bar insignia (on the fuselage at the right of the tour number) authorized by the Amateur Air Pilots' Association.

Above: Final conference of pilots and guests in front of the Hicksville clubhouse. The yachting cap conspicuous in the center background is a souvenir of the seaplane cruise staged by the Aviation Country Club of Long Island during the summer of 1930.

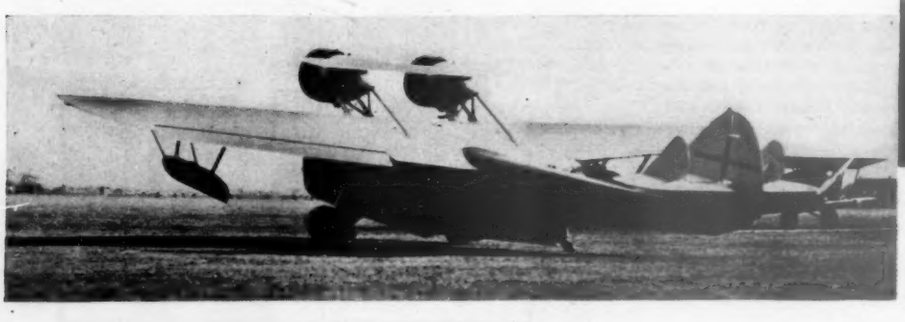
Above: A Stinson getting underway, as seen from in front of the clubhouse. At bottom: Powel Crosley's twin-engined Douglass amphibion was used as a flagship by Maj. Paul Burwell, the cruise manager.

Below: "Pirates" greeted the air cruise at St. Simon's Island, the third over-night stop.

When amateurs cruised to Miami

Snapshots of the recent tour from New York to Florida

Aviation photos



Above: From winter to spring garb. Betty Huyler Gillies at the start of the cruise at Hicksville, and at Pinehurst, the second over-night stop along the route.

Aviation Country Club of Long Island members in 1931 provided a market for $500,000 worth of aircraft. With the members of the Amateur Air Pilots Association they have hung up an enviable safety record, which has resulted in greatly reduced aircraft insurance costs, and they both speak their minds about the refinements desired in flying equipment for the private owner.

Non-professional progress

THOUGH non-professional flying in this country has lagged far behind what was expected of it in 1929, there are a number of bright spots in that segment of aviation. On the part of the professional (commercial) groups in aviation there has been so much disappointment because private flying has not developed along the particular lines which they happened to expect, that most of them have washed their hands of everything connected with non-professional activities. Not a few of these are frankly contemptuous, declaring they see no non-professional market, real or potential, and concentrating all their efforts in serving the various elements of military or strictly commercial flying.

This neglect of the non-professional jeopardizes the desired expansion and prosperity of commercial aviation by confining it to catering merely to other members of the industry. Certain limits have been reached already in marketing possibilities offered by the transport operators, the airports, the base operators. The non-professional market stands as the commercial operators' greatest single opportunity, but they are doing woefully little to develop it. The records of the Aviation Country Clubs and the U. S. Amateur Air Pilots' Association under the direction of John S. Reeves, indicate more clearly than ever that a non-professional market is beckoning and that, despite the apathy of the professionals, notable progress is being made in actual private operations.

One of their most striking contributions is the demonstration that non-professional flying when properly conducted has a very high factor of safety. In its two and a half years of operation, there has been no forced landing from engine failure on any of the four planes owned by the Aviation Country Club of Long Island, or owned by the members and maintained at the Hicksville hangar. An average of 60 members' machines are housed there all the time. This is impressive evidence in support of the contention, long advanced by devotees of non-professional flying, that the activity can be developed as one of the safest phases of aviation, if certain premises are observed. There must be *unceasing, painstaking maintenance* of equipment and *rational operation* of that equipment.

Proper maintenance depends upon the integrity of mechanics employed and their methods or, if one maintains his own equipment, upon the calibre of the individual. Proper operations, it has been demonstrated, may be expected from the type of man who successfully carries family, business and social responsibilities, and who goes into the sport intelligently. The spendid performances of the amateurs under the extremely bad flying conditions during the January cruise to Miami and the little better conditions during the August cruise to Cleveland lend powerful testimony.

The club planes alone were flown 834 hours during the year ending June 30, 1930, and 767 hours in the year ending June 30, 1931. Housing and maintenance are provided at less cost than at most fields in the New York City area. Considerable encouragement to those interested in the problems of group ownership and operation of private aircraft may be derived from the fact that the club has practically broken even financially in the last eighteen months, despite distinctly discouraging economic conditions. The Hicksville plant is valued at $350,000 which is vastly more than the average soundly-planned flying club would need to assume. Its operating income and expenses are correspondingly high, income and expenses each amounting to about $75,000. Membership has dropped some, but averages around 500.

Insurance rate victories

Another extremely important contribution is the reduction of private aircraft insurance rates. The high cost of insurance has been and continues to be a serious problem in the development of non-professional flying. In many ways the insurance companies cannot be blamed for high rates, and it is to their credit that the assurance provided by such organizations as the Aviation Country Clubs and the Amateur Pilots' Association are recognized as producing a desirable type of non-professional flying, and therefore meriting special treatment. One assurance is that the owner of an airplane under the auspices of either association is a responsible person with family and business obligations which make it unlikely he would allow carelessness or unnecessary risk to enter into his flying. Another assurance, which is really a complement of the foregoing, is that the extremely vital matter of proper maintenance will be adequately pursued.

Though the Amateur Association members enjoy advantages of special rates, the greater part of the pioneering work was done by the old Aviation Country Club group. On the basis of its remarkable record, the rates have been reduced three times, so that they now range 20 to 30 per cent lower than the premiums levied against the average unattached non-professional operator. In two and a half years of Aviation Country Club operation insurance companies had to pay only small losses.

While the reduced insurance premiums react for the time being chiefly in favor of the aforementioned groups, as time goes on the benefits are certain to be enjoyed by all non-professional individuals and groups who conduct their activities in accordance with high standards. In the immediate future growth in the number able to take advantage of these more favorable rates probably will coincide with the expansion of Aviation Country Club and Amateur Air Pilots' Association memberships. While the former adds members by invitation only, the latter is broad enough to include all of approved amateur standing.

The possibilities of the non-professional market for the manufacturers are indicated by the fact that members of the Aviation Country Club who have no professional connections with the aviation industry bought 44 airplanes in 1931 at a cost of $488,200. This was just under the 48 bought in the boom year of 1929 at a cost of $494,680 and was a gain in total investment over the 48 bought in 1930 valued at $377,995. The models varied from the light Aeronca and Avian classes to the Sikorsky class. One hundred and two

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members have bought planes up to 1932. Fifteen bought two machines, seven acquired three, one bought four, and one five. Thus 23 per cent of the owners repeated their orders.

This is an important market, the significance of which is not lessened by the fact that this particular group is made up of individuals with outstanding financial and social background. It indicates that *price*, not *fe w*, is holding down the number of private owners. Planes are bought by those who have the desire to fly and who can afford them. The conclusion must be that more would be bought if more individuals could afford the investment and cost of operation. The majority of even the wealthy owners consider the plane unreasonably expensive to buy and fly.

Non-professional flying in the past has suffered from the lack of group consciousness and cooperation. The activity has had no one to coordinate it, to present its point of view, to secure the recognition it deserves. Amends in this direction are being supplied by these two organizations. Existing for and by the sportsman owner they are stimulating activities, giving substance to the private pilot's own problems and point of view. Through them the social side of flying, essential in any sport, is being cultivated. The organized activities bring into stronger relief the vast recreational and sporting attributes of flight, aspects deplorably overlooked and undeveloped.

Contests and cruises

The seaplane cruise staged last summer by the Aviation Country Club attracted eighteen machines and 55 participants; the amateur cruise in August to the National Air Races attracted thirteen planes, 38 persons; and that to Miami in January for the annual meet there 22 planes, 60 persons. The spring and autumn meets held annually by the country club, add interest to the sportsman pilots' year. These events have been so popular that little advance promotion is needed to secure entries for a meet or cruise. Further developments of such organized activities will include recognized amateur events at the National Air Races, and an annual contest to determine the ten outstanding men and women pilots, from whom will be selected the national champions.

Such groups as these know what they need for flying equipment. They have advanced ideas on the type of craft best suited to the private pilot and the sort of activities most likely to prove advantageous to their interests in the future. Flying for sport has its own characteristics, an important point which has not been adequately appreciated by the average designer, manufacturer, and salesman. No one can speak with as much authority as the sportsmen themselves, and yet their comments usually have gone unheeded by the majority of those who should be paying attention.

Questionnaires to a number of leading private owners have produced illuminating opinions regarding characteristics they would like to see incorporated in machines they own. A contest between the ideas of the professional and the non-professional at once appears. The former in discussing his ideal plane lays great stress on speed, maneuverability and the general flying characteristics. The latter, while deeply interested in the flying qualities, has another point of view. He thinks a great deal, and justly so, of the refinements which produce comfort in machines he already considers otherwise suitable for his type of operations. This is just another tip to the commercial people that they must give attention to such details even as the automobile and motor boat interests did in order to develop their markets.

Reduced cost of equipment and operations is the most desired change, but a very close second is the need for extensive improvement in the general *convenience* of all aspects of private flying. This is something for every element in the industry to worry about because it affects a wide diversity of subjects, such as location of landing places, facilities at airports, ease of handling a plane, and ease of boarding or leaving it.

There is a practically unanimous appeal for such a simple consideration as provision of more baggage space. Anyone who has made a week-end or vacation trip in a conventional two or three-place plane with all seats occupied will share the prevailing conviction that the accoutrements necessary for such an excursion must be provided for adequately, and that the usual space available is not sufficient. Full provisions for luggage have been made in every other medium of transportation and the private owner's airplane must be just as well arranged, even to the handling of bulky golf bags. Designers are beginning to do something about this.

Another refinement of vast importance is the introduction of more comfortable seats, particularly those arranged for parachutes. The average seat at the present time becomes extremely uncomfortable after an hour or so in the air, a bit of torture hard to justify even to the most ardent sportsman, and one not at all necessary. We are used to high standards of comfort; they are the selling points emphasized in countless non-aeronautical products; they should be studiously provided in private planes.

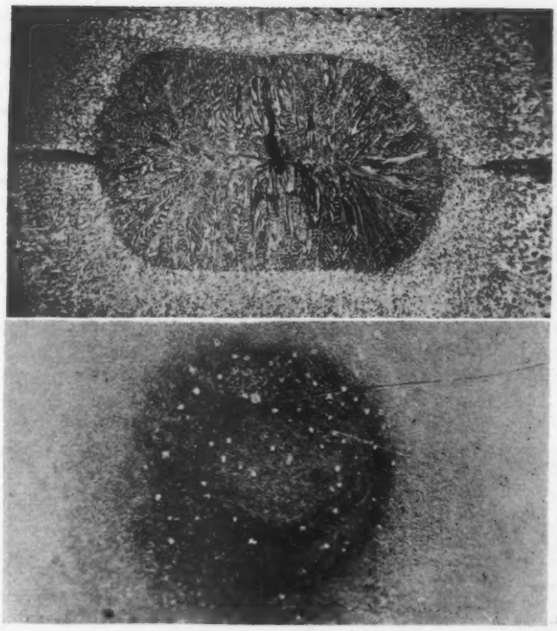
Closely allied to the demand for more comfortable seats, and equally important, is that for less drafty cockpits, owners suggesting that cowls and windshields be designed to reduce or eliminate this annoyance. This is another instance where "roughing it" is no longer essential or desirable. Ease and simplicity of all phases of operation are taken for granted by Americans, but in aviation they are usually lacking. Notable advances in this direction would be achieved by such improvements as installation of self-starters as standard equipment and arrangement of more convenient access to engines for servicing and checking. A cruising range of at least 600 miles to reduce the likelihood of forced landings on cross-country flights has been suggested; also front seat covers and detachable windshields to streamline a vacant front cockpit.

Better airport facilities

To the airport operators and service companies, groups bound to benefit tremendously by an expansion of private flying, the owners suggest many refinements. Provision of rentable individual lockers at airports where luggage and equipment may be stored safely over night, hotel or sleeping accommodations at airports so that the gipsy amateur need not always have to undertake the usually long surface trip between the port and the downtown hotels, uniform rates for servicing and overhaul work, reduction of retail cost of parts and fuel. Such hints should cause the airport operator or the units operating on an airport to adopt a broader attitude toward the non-professional pilot and to seriously cater to the many little things which contribute convenience and comfort. Careful attention to such details is but good business.

From the replies there can be no doubt that one of the primary problems in the evolution of the non-professional field is that of reducing prevailing cost of equipment and upkeep, even among people classed as wealthy. The expense simply must come down, if an expanded, profitable non-professional market is to be realized by the plane manufacturers, the dealers, the accessories makers. It must come down if the sport is ever to become what its devotees consider it capable of. Reduction of original cost is a matter for the designers and manufacturers to solve. If it is not accomplished now, it will be by a new generation of manufacturers and designers. An alibi that the time will be more ripe later will be only part of the truth. There is a large potential market now, there was a larger one three years ago, but an almost universal failure to understand, to actually see it and meet it with the product it wants, retards the non-professional movement from the point of view of the commercial interests as well as from that of the participants.

In the meantime, the Country Clubs and the Amateur Association are proceeding with their non-professional programs, gradually getting across to the rest of aviation the differences between commercial and sport flying—the facts that each have their own field, their own requirements, their own problems, their own opportunities—all the while consolidating those interested in flying-for-the-fun-of-it into effective groups.



Top: Micro-photo of a weld. This clearly indicates that the molten condition does not extend to the outer surfaces. In this case the time element was excessive; the definition between weld and adjacent material is too sharp

Below: Rusted corona. This weld was made on a commercial welder set for one-half second. The bond is good, but a rust ring around the core indicates spoiled stainless—the corona. The white spots are salt deposits.

Stainless steel and shot-welding

By E. J. W. Ragsdale
Edward G. Budd Manufacturing Company

Attention of aeronautical engineers has been attracted for some time to the physical properties of the so-called stainless steels. This class of material is of interest largely because of its strength and corrosion resistance characteristics. ¶ One of the serious drawbacks to the use of this material has been the difficulty in fabricating airplane structural units from it and research on this problem has been progressing in several commercial organizations in various parts of the country. The author of the present article has been actively identified with the development work for a long period and has outlined its progress from time to time in contributions to AVIATION.

AN advertising man coined the term "*stainless* steel"; he liked the sound of it and the implication of virtue. A steel man voiced objection; he said the material was neither *steel* nor, of necessity, stainless.

"Good," argued the advertising man, "it will provoke discussion." And so it did.

For the past twenty years stainless steel has been more widely discussed than used.

It has required imagination and courage to introduce a 50-cent steel into a field where a 4-cent article apparently suffices. The aircraft industry has indicated the way by making *weight—strength relation* a vital fact rather than a term of academic interest. Aviation has exhausted the weight-saving possibilities of about every structural material so far known, except those of stainless steel. In this country the lighter alloys predominate, while in England thin carbon steel is favored. Both confess to certainty of corrosion and accept it. The way out through stainless steel seems to have offered too devious a path. It means a change in sense of values where one is accustomed to duralumin, of a reversal of habits of thought where one is used to heat-treated steel.

Stainless steel has vagaries—rather pleasant ones in fact. There are a dozen or more varieties offered under the name *stainless* or *rustless* and they are all different. But fortunately for the purpose of this article, the issue can be confined to one specific composition, namely that characterized by 8 per cent nickel and 18 per cent chromium. It is known as "18-8," "Allegheny Metal," "KA2" and by a score of trade names. It is perhaps the best adapted to structural use of any of the alloys offered. Even disregarding its corrosion—resisting character—18-8 possesses physical properties which would make it an outstanding useful metal.

Certain vagaries, however, have been mentioned. They are apt to be disconcerting if one adheres too blindly to conventional steel practice. For instance, 18-8 may, or may not be magnetic; it may or it may not be corrosion resistant; it may have the hardness of tool steel, or it may have the consistency of wet cardboard. The electric resistance can be anywhere from seven to twelve times that of ordinary steel. The softest, most ductile state is obtained by heating to about 2,000 deg. F. and quenching. What would seem to be normal shop practice in working or welding the material may destroy its every good quality.

Explanation of such behavior is found by the metallurgist, in the fact that 18-8 is *austenetic*. In this state it is a solid solution of iron and carbides, a perfectly homogeneous material. Ordinary carbon steel is also austenetic, but only between the temperature of solidification and a dull red heat. Then it, too, is non-magnetic. Magnetic and other familiar properties are picked up only after temperature falls below the critical point. At this point, carbides are precipitated out of solution, to form grain boundaries. The material is no longer a solution; it is no longer homogeneous, it is a mixture.

Nickel, chromium and carbon combine to lower the critical point of 18-8 to temperatures well below zero, or, in other words, to preserve the austenetic state. This condition, however, obtains only for cooling. Upon reheating some indication of a critical range manifests itself below 1,600 deg. F., where carbides are separated out and the austenetic state is no longer complete. The material loses resistance to corrosion or fatigue and responds to the magnet even after cooling. It can be reconstituted only by heating to 2,000 deg. and quenching.

These phenomena assume the utmost importance in connection with welding operations, for these must, of necessity, be a zone adjacent to the fused area where the metal has reached the critical. The affected zone is commonly termed "the corona." Its location and extent can only be determined by microscopic examination of etched sections. The excluded carbides appear significantly as grain boundaries and in isolated pockets. Surface discoloration also appears near the weld but is an unreliable indicator. Since it is seldom practical to recondition a welded structure by heating to 2,000 deg., the ease of welding 18-8 is a doubtful virtue.

Heat is not alone in its ability to destroy the austenetic state. Excessive cold work can do it, and care must be taken against severe bends or formations of material which has already been cold-worked. Eighteen-Eight may be given a tensile strength well over 400,000 lb. per sq.in. but at the expense of corrosion resistance. At 200,000 lb. ultimate it is both workable and stainless.

Unfortunately recital of all the above is necessary for many, seeking to find in *stainless* a panacea for all material ailments, have suffered disappointment—a disappointment attributable to ignorance of these conditions rather than to shortcomings of the material itself. Eighteen-Eight is a wonderfully stable alloy when not abused, and justifies every confidence of the designer. It requires a special technique, naturally, but what material does not? Tragedy accompanies chiefly the effort to use a technique developed for one material in fabricating another. That evolved in England for thin steel structures approaches, but is not immediately translatable to the ideal for 18-8. There the practice is to form the steel into sharp curves, rivet and then heat-treat. Eighteen-Eight refuses to conform. It cannot be improved by heat-treatment; its physical properties are a function of cold rolling in the sheet or strip. Springback, due to the very high elastic limit makes curves formation difficult and a sharp bend is required to set the metal. As a consequence, sections are apt to consist of a series of flats, corners, and beads.

Nor is riveting entirely satisfactory. The metal hardens too fast under the point of easy drilling. Punching is correspondingly difficult. Besides which, any rivet having shear values commensurate with those of the plate would be too hard to head over.

Difficulties of spot-welding

Spot welding offers the only economic and reasonable solution but here too deference must be made to the peculiarities of the material. Electric resistance is some ten times that of carbon steel, which is favorable. The surface is clean, which is all important. An air quench from heat of fusion does not make for brittleness. It is axiomatic in the welding fraternity that the weld never fails, it is the metal adjacent, and we have seen enough of the result of reheating 18-8 to know that we must be on guard against *corona* effects.

The Budd shot welder. In aircraft work, a portable machine is essential. Cables are often strung out for 20 ft. from machine to operator.

Spot welding is in reality a microscopic foundry practice. The metal between electroded points is brought to fusion by its resistance to an imposed current. The heat effect is I^2RT where I is current; R, the total surface and internal resistance between electrodes and T, the time of application. So we have an electric cupola furnace, the walls of which constitute a chill mold. If only sufficient current be used to fuse the metal in line with the electrodes, then heat is quickly dissipated into the surrounding material. The volume of the metal is quite definite, the amount of current and time must be correspondingly so. If too much current be used, or for too long a time, the metal is boiled and excessive heating of the material adjacent to the weld results.

Between the molten region and the material that lies far enough removed to have been unaffected, there is a gradient—a drop from some 3,000 deg. F. to room temperature. Onion fashion, there appear concentric zones of material which have cooled from varying temperatures. The danger zone is that which has reached 1,200 to 1,600 deg.

It is readily seen that the time of current application is important. A very long time for a small current would result in complete dissipation of heat by conduction and radiation—and no weld. A relative shorter time might result in a weld, but still with a large heat loss to adjacent material. The shorter the time and the more accurately gauged the current the narrower will be the temperature gradient, as well as the period of cooling. Here, too, enters another factor, namely the period of cooling, for it takes time to precipitate carbides and to change grain structure. A heat operation completed in an incredibly short time leaves the adjacent material in a healthy state, but if the application of the heat is too long protracted and a weld results, it will be like a rivet surrounded by *mush*.

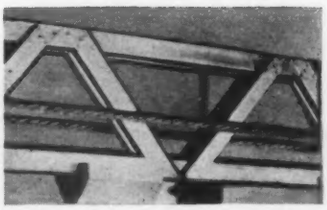
Shot-welding

An infinitely short dwell of current is indicated. That the watched pot never boils may be a good tea-time conversation, but, in reality, time is not an essential factor of heat. Lightning has done some good short-time melting, and spot welds have been consistently made in 0.0001 second. Such explosively impressed high currents have prompted the term *shot-welding*, as distinguished from the more conventional form *spot-welding*. In that latter the time may or may not be regulated but in any case covers a substantial fraction of a second. While any spot-welding apparatus may be adapted to use for stainless steel, the best results are to be had from one where transformer and timer are designed for the specific purpose intended, and where the operation is made as largely as possible automatic.

While current and time settings should normally insure uniformity of result, such is unfortunately not the case, and the old question is ever present: "How do I know it's a weld?" A dozen variables enter into the problem; clean

surfaces, good contacts throughout, electrode pressure, voltage line drop, etc. Surface appearance means nothing, the best welds often leaving the least indication and vice versa. This is understandable when it is realized that fusion seldom extends to the outside surfaces. What one sees is an entirely localized condition due to good or bad electrodal contact.

Furthermore, the mere fact that fusion has resulted does not necessarily indicate that a good weld obtains. Welds vary in character from being very brittle to dead soft. A weld having a high shear value lacks tenacity and is apt to *snap;* while a soft one may be surrounded by a corona which spells failure by fatigue. A properly made weld of two thin plates of 18-8 will permit of twisting one plate welded to another by at least 90 deg. in the weld before the weld shears out of one of the plates, leaving a hole in that one and a plug on the other. The failure never comes in the actual fused material that has flowed across between the plates. As in riveting, there is a definite philosophy governing weld-quality, size, spacing, and so forth. Suffice it to say that a shot-weld in 18-8 should show twice the shearing resistance of a rivet of like diameter and of the same material. Weld diameter is a function of metal thickness and, strange to say, is determined by current setting or applied voltage, not at all by the size of the electrodes. In airplane work the thickness of the plate used is likely to run from .015 in. to .040 in., and a typical weld is about $\frac{1}{8}$ in. in diameter. The welding up of continuous strip structure, such as a spar, the welded spots lie from $\frac{1}{4}$ in. to $\frac{5}{8}$ in. apart. Time and current relation alone determine the physical character of the weld.



This spar failed under a test of 2½ load factors over and above the designed load. Its weight was identical to that of the spruce spar it was designed to replace.

If a single factor be sought for measuring the uniformity of the welds produced by machine, it is best afforded by the record of the total heat units, or watts of energy, dissipated in the flow of the welding current between the electrodes.

All of this might well have remained a pleasant philosophy rather than a practice, had it not been for the invention of a "weld recorder" which not only writes on a tape the heat units entering into each weld but also gives audible notice of any variation.

The "weld recorder"

The operator of the machine has only to bring the metal into place for each successive weld and depress the treadle which brings the electrodes together against the work and operates the switch and the automatic timer. If the amount of energy flowing through the metal during the welding process falls outside the prescribed limits for an ideal weld, a bell rings to warn the workman that something is wrong, and also to attract the attention of the foreman or inspector. If the warnings of imperfect welds become recurrent, it is evident that the controls of the machine require adjustment, or that something is wrong with the material. At the same time a pencilled line is drawn on a moving strip of paper for each weld, the length of the line proportional to the energy used. Thus the inspector has a permanent record for reference. On simple strut welding on flat or slightly curved surfaces a good workman can make up about 60 welds in a minute.

With this device, not only has shot-welding been given the reliability of riveting but it is cheaper, quicker, and demands less space. It appears to have been the last of a series of developments required in order that stainless steel may assume those structural uses for which it is otherwise so peculiarly suited.

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The torpedo plane's advantage over the naval bomber

An abstract of an article by Lieut. Logan C. Ramsey, U.S.N.,

United States Naval Institute Proceedings

AT THE present time the Navy has not provided types exclusively adapted to bombing and torpedo attack, respectively. The two forms of offense are combined in one general heavy duty machine. The author believes that a clear distinction must be drawn between the two types in order to permit comparisons between the relative efficacy of each type and to assure full exploitation of each one.

On the basis of the mixed bombing and torpedo missions available planes have been called upon to perform, he believes the torpedo type holds the greater promise of the two in naval warfare. The bomber obviously would tend to be a larger and slower flying machine than the torpedo plane. Size and consequent ease of handling and number of units which may be housed are important considerations of any machine designed for aircraft carrier duty. The bomber is slower than the torpedo plane, and takes longer to reach its target, since it must attain a certain high altitude before venturing into the target zone. The torpedo plane, by virtue of the fact that it operates close to the water, need but fly directly toward its target, and by the same token would be able to make more attacks on a given target in a given amount of time than would its slower, higher flying counterpart. The difference in position makes it much more liable to score a hit.

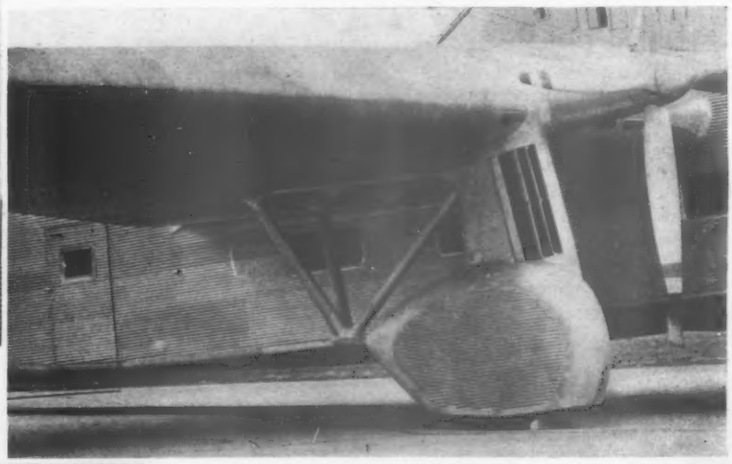
The author believes, too, that the bomber is more liable to be struck by anti-aircraft fire than is the torpedo plane. The bomber must hold a steady altitude and direction preceding the release of bombs in order to take accurate aim. Bombers also must fly in a fairly close formation to provide an effective bomb pattern. Both of these restrictions increase the possibility of effective anti-aircraft fire. A torpedo plane, on the other hand, may be maneuvered to disturb enemy range finding practically up to the point of launching its cargo, when for a brief period of a few seconds it must be pointed straight at the target. The general better maneuverability of the torpedo plane in itself makes it more immune from defense fire.

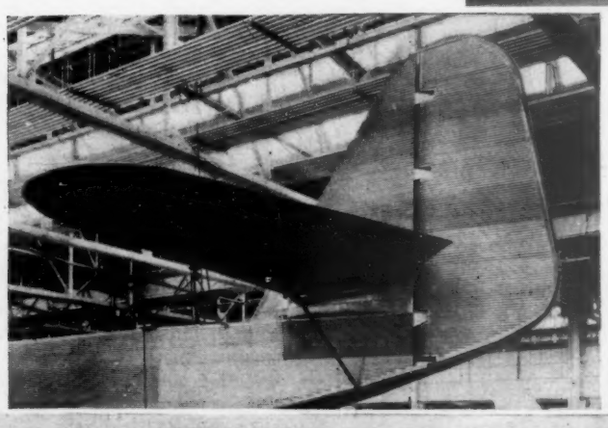
The torpedo plane is less affected by average weather and visibility conditions and may operate with the advantage of aerially laid smoke screens for protection or a certain element of surprise. It can cooperate more effectively with surface vessels because of its proximity to the surface.

The author concedes that the bomber's target has less opportunity to escape by maneuvering and that a bomb is potentially more destructive than is a torpedo. However, in the light of the above conclusions he considers it would be wise policy in the event of war within the next five years to eliminate the heavy bomber from all aircraft carrier operation and concentrate on a strictly torpedo type in greater numbers, at the same time admitting that in time of peace development of bombers should not be limited until the range of effectiveness of the type has been proven.

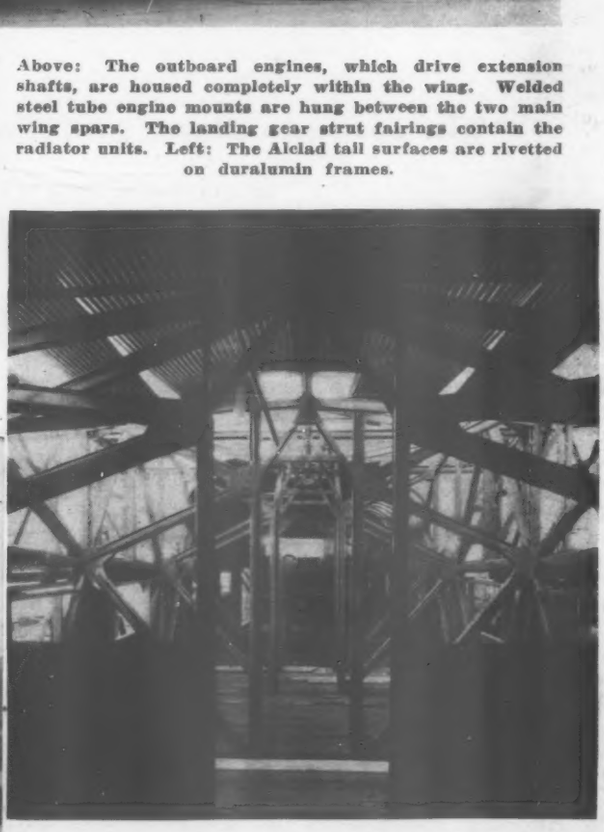
Above: The first impression of the Ford 14-A is not so much one of size (despite its 110-ft. wing span), as extraordinarily clean lines.

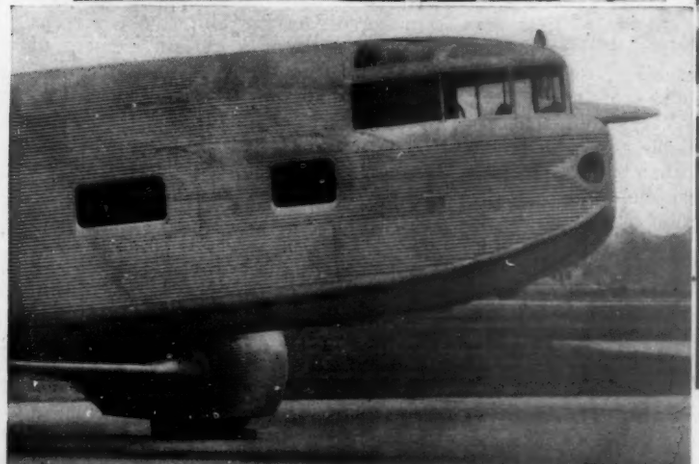
Above: The carefully faired housing of the center engine follows the contour of the 1,100-hp. Hispano-Suiza.





Above: The outboard engines, which drive extension shafts, are housed completely within the wing. Welded steel tube engine mounts are hung between the two main wing spars. The landing gear strut fairings contain the radiator units. Left: The Alclad tail surfaces are rivetted on duralumin frames.





Above: The cabin structure permits full headroom throughout its entire length. Left: The situation of the pilots' cockpit affords a clear view forward and downward.

The new Model 14-A embodies design features never before attempted in this country

The big Ford transport

IN SPITE of the reluctance of operators to consider the replacement of equipment at present, the Ford Motor Company is convinced that the time is not far distant when airplanes of large passenger capacity will be required by the great transcontinental trunk lines. As a first step in this direction, the Model 14-A has been designed, and the first machine of this type recently completed.

From its inception the requirements of the transport operators have been the primary consideration. Not only have questions of passenger comfort and convenience been taken into full account, but, more important still, the problem of economical servicing and maintenance has been given the most careful study. During the design stages, servicing mechanics, maintenance shop foremen, and field service men were called in for frequent consultation with the designers. In considering layouts the problem was never, where can this or that gadget be put to get it out of the way?—but rather, how can the parts be so related that any one of them may be fully and instantly available for inspection or adjustment without interfering with other parts, or without dismantling whole sections of the airplane? As has been constantly reiterated in these pages, the success or failure of an airplane in transport service may well depend upon the consideration given to the question of maintenance and servicing facilities in the various stages of design.

The saying that engineering development progresses most rapidly in periods of business depression finds no better illustration than in the recent activities of the Ford Motor Company. With general business conditions at their lowest ebb in the industrial history of the country, Mr. Ford has seen fit to take advantage of the reduced pressure on his production departments to engineer radical departures from established standards in both the automotive and aeronautical fields. The long expected eight-cylinder car, and a large passenger transport airplane involving features never before attempted in American design practice, are the tangible results of these efforts.

Outstanding features

Although the airplane measures 110 ft. from wing tip to wing tip, and slightly over 80 ft. from nose to tail, the first impression when approaching it in the open is not of size, but rather of extraordinarily clean lines. Except for two small pieces of tie-rod, each not over 6 ft. long, connecting the stabilizer with the fuselage, there are no exposed wires of any kind either for bracing or control. External struts have also been reduced to a minimum. Where they are used, however, they are well streamlined, and careful attention has been give to all points of attachment. Obvious effort has been made to reduce interference drag. Generous fillets are provided where wings meet the fuselage, at points of attachment of the undercarriage, and in carrying the lines of the fuselage into the fin and rudder. The cowling and fairing of the center nacelle and its support is a beautiful piece of work. A remarkable continuity of line has been achieved throughout the entire plane.

Immediately in back of the pilot's cockpit is a small compartment which will probably be used as a smoking room. Continuing aft along a center aisle, there are two passenger compartments, two washrooms, (one on each side), followed by two more passenger compartments. The aisle then passes between a baggage room on the port side, and a galley to starboard, and ends in a transverse passage with entrance doors on each side of the fuselage. A doorway also gives access to the rear part of the fuselage and the tail wheel assembly. Each of the four main passenger compartments has seating accommodations for eight persons. Except that the center aisle is somewhat narrower, each compartment has the same dimensions as a double-section of a standard railway sleeping car. The seats are of the usual width and depth and the cushions slide down and across to form a sleeping berth of standard railway size. Folding upper berths may also be installed. The machine may thus be converted from a daytime passenger carrier into a sleeper whose accommodations are similar to those available on the railroads. It is not the intention that sleeping equipment be carried in the daytime, however, but rather that the upper berth, mattresses, pillows, bedding, etc. be installed at the point of departure for night runs.

The decorative scheme of the cabin interior is decidedly modern. Every possible device has been installed for the comfort and convenience of the passenger. The galley is equipped with a stove and refrigerator. A built-in annunciator system makes it possible for passengers to summon the steward from any compartment. Great care has been taken in insulating the cabin against sound, and temperature variations. The walls and ceiling are of double construction throughout, enclosing a relatively large volume of dead air space, and the interior paneling is of composite construction, consisting of a balsa wood core between sheets of aluminum. Thick pads of insulating wool are provided in the roof and side walls in the vicinity of the engines and propeller to further deaden noise, and to reduce vibration in the plane of the propellers.

A complete thermostat-controlled heating and ventilating system is installed. To prevent the disruption of the normal functioning of the air supply, all cabin windows are fixed in their frames and cannot be opened. Fresh air enters a screened and muffled duct

opening into the leading edge of each wing in the slipstream of the outboard propellers, and passes over heating coils in which hot prestone is circulated. Excess hot prestone is by-passed back into cooling radiators which are independent of the engine cooling system. The warmed air passes into a central duct running the length of the cabin over the center aisle, from which manually-controlled registers open into each compartment. Used air is exhausted from the cabin through mushroom type ventilators installed under the seats. Each ventilator is connected to small louvres in the underpart of the fuselage, so arranged that a reduced pressure is maintained through the ventilator at all times while the machine is in flight. Each outlet is also provided with a muffler to prevent the infiltration of outside noise. The total volume of the passenger space in the cabin, excluding toilets, galley, and baggage room, is 1948 cu.ft. The baggage compartment which is provided with doors opening both to the outside of the fuselage and to the cabin, has a capacity of 137 cu.ft. The passenger seats have been constructed to permit the stowage of a suitcase underneath.

The general arangement of the airplane and its principal dimensions are shown in the accompanying three-view drawing, and attached table. The following paragraphs cover some of the structural details of the machine, many of which differ widely from standard practice in airplane design in this country.

The fuselage

The fuselage is of all-metal construction of the usual Ford type. Due to the concentration of power plant weight near the center of gravity, conditions for balance require that a large percentage of its length be located ahead of the leading edge of the wing. In this respect, the arrangement is somewhat similar to that found on the Handley-Page Hannibal, or, to a lesser degree, on the Curtiss Condors. The cross section is approximately rectangular from bow to rudder post. The flat top surface is broken only by the rounded cockpit cover forward and the upper surface of the wing amidships. The bottom surface is parallel to the top for the greater part of the length, sweeping up rather sharply in a modified vee form under the cockpit, and more gradually up to the rudder aft of the cabin door. This arrangement permits full headroom throughout the cabin.

All of the framing members of the fuselage, with the exception of the three main bulkheads at the point of attachment of the wing, are of formed duralumin sheet, riveted together. In the section where the short wing stubs and the mounting for the center engine nacelle are integral parts of the fuselage structure all main members are constructed of special alloy steel rolled sections, heat treated to a tensile strength of approximately 190,000 lb. per sq.in. The main bulkheads in this region are virtually continuations of the principal wing spars. A diamond type girder construction carries the wing beam stresses across the fuselage and around the openings in the bulkhead required for aisle doors. These members tie in under the cabin floor with the two deep girders which form a keel for the fuselage.

Wings

The full cantilever wings are of the usual Ford multiple spar design, involving two main and three active auxiliary spars. In the tip sections, false spars carry the aileron hinges. The wings are very thick at the root and taper both in plan and thickness toward the tips. Each is in two parts,—an intermediate section carrying the outboard engine, extending from center section stub to a point about 50 per cent of the semi-span, and a tip section carrying the ailerons. The profile is a modified Ford No. 2 airfoil.

The spars and stringers of the intermediate sections are built up of rolled alloy steel section of the "Omega" type. The framing of the tip sections is similar to that of the inboard panels except that duralumin is used throughout in place of the steel. The intermediate sections are reinforced for drag by crossed steel tie-rods and girder-type steel compression struts. All of the internal members both steel and duralumin, are coated with corrosion-resisting paint before assembly. The covering of the entire wing is corrugated Alclad. Panels are bolted together through drop forged steel fittings.

Power plant

The power plant consists of three units: a 1100-hp. "W" type Hispano-Suiza engine, mounted in a nacelle over the center section, and two 720-hp. Hispanos mounted outboard in the wings. The center engine is direct connected to a three-bladed Hamilton Standard propeller, and the wing engines drive four-bladed Hartzell wooden propellers through 2:1 gear reducer and shaft extensions. All engines are water-cooled.

The mounting and arrangement of the center engine and its accessories is conventional, although extraordinary attention has been paid to its cowling and the fairing of the supporting structure. The housing follows the contour of the engine very closely, and is remarkably free from unfaired projections. Numerous inspection doors, and large removable sections of cowling permit adjustment and servicing. The main cooling radiator (cartridge type), and the oil cooler are housed in the nacelle support fairing. Both are set at such an angle that their faces are normal to the slipstream. Manually operated shutters are provided for temperature control.

The arrangement of the outboard engine mounts and the propeller drives constitute one of the most interesting features of the design. For the first time in American practice, engines have been housed completely within an airplane wing, although the advantages of such an arrangement have long been recognized. Parasite drag is reduced, wing and propeller efficiency are materially improved, and the engine is accessible for minor repair or adjustment in flight. In the new Ford, a wing thickness of over 50 in. at the outboard engine stations provides sufficient depth for complete enclosure, and leaves a limited working space where emergency attention may be given.

In order to avoid breaking the wing contour at the leading edge, and to permit the location of propellers far enough ahead of the wing to operate with maximum efficiency, extension drive shafts were provided.

Support for outboard shaft bearings was obtained by use of a welded steel tube structure cantilevered out from the front wing spar, similar to an ordinary radial engine mounting ring but of smaller diameter. Special universal joint ball thrust bearings inside the wing structure carry the inner ends of the hollow steel drive shafts. The front bearings are of the self-aligning ball type.

Welded steel tube engine mounts are hung between the two main wing spars. A three-point suspension system permits a certain amount of wing deflection without destroying the alignment of engines and extension shafts. The universal joint drives can handle a 3-deg. misalignment, which is far beyond any anticipated from wing deflection.

The problem of designing the shafts and bearings was simpified by the introduction of reduction gears to bring the normal shaft speed down to 900 r.p.m. Aluminum spinners, and cylindrical housing around the bearing supports carry the line of the propeller hubs smoothly into the leading edge of the wings. With such aerodynamically clean mounting the large diameter, slow turning propellers should show unusually high efficiencies.

Having gone to such lengths to house engine and drive, it would be obviously undesirable to spoil the effect by permitting radiators to project into the windstream. Wing surface radiation, although theoretically the best solution, offered many practical difficulties. By taking advantage of the fact that the main landing-gear struts came almost directly below the outboard engine mounts, a most ingenious combination of radiator and strut was worked out by placing the radiator units and radiator control shutters within the shock

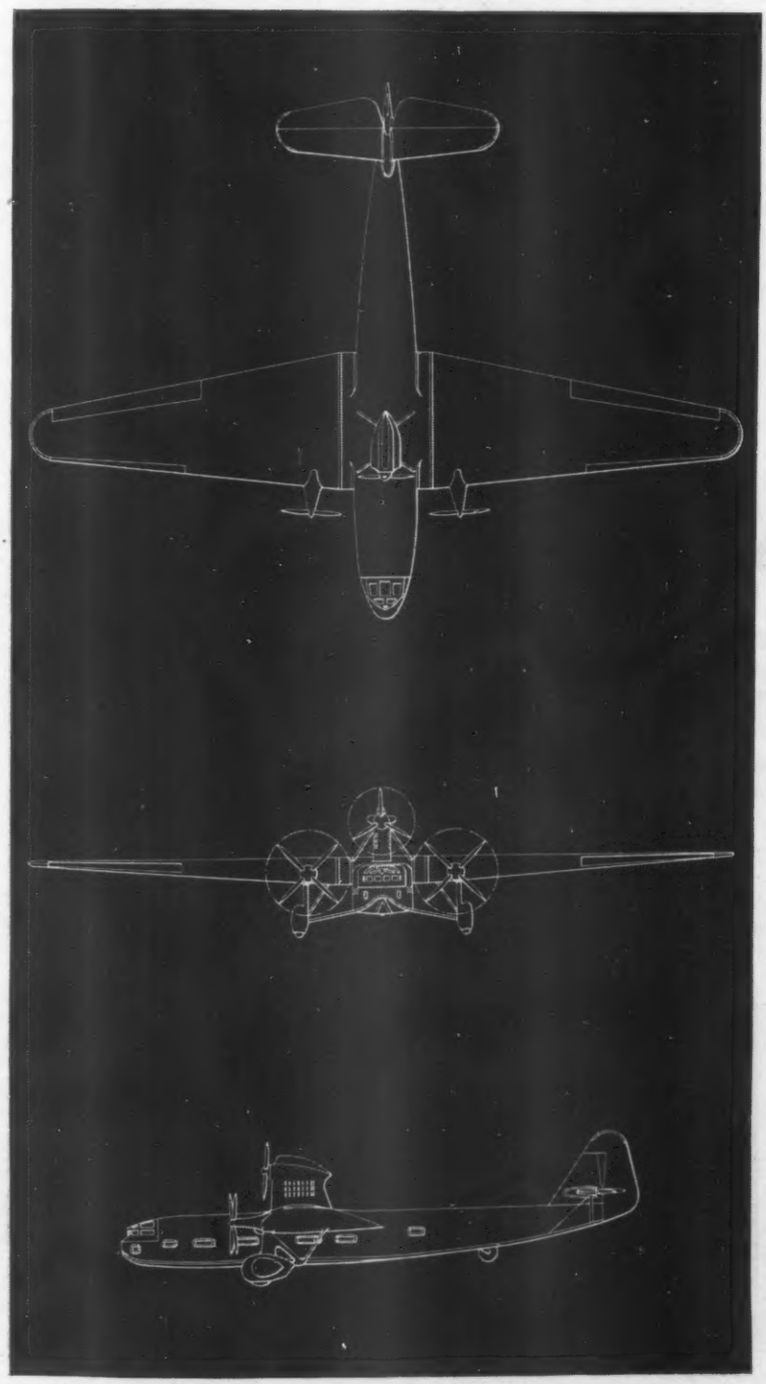
strut fairings. The parasite drag of the combination is undoubtedly greater than that of a normally faired wheel support alone, but taking into account radiator drag and interference effects, there is no question but that the net gain in overall efficiency is appreciable.

Carburetor intake air for each engine is drawn through two screened openings in the leading edge of the wing in the region where the dynamic pressure effect would tend to give a slight degree of supercharging. Exhaust manifolds discharge through openings flush with the top surface of the wing at a point about 75 per cent of chord from the leading edge. Since these points are well within the high velocity, low pressure area, a certain degree of scavenging effect is available.

The wing engine compartments are fully surrounded by a fire wall. On the ground, access to each is gained through hinged hatches in the upper wing surface. An entire engine may be removed through the hatches by unbolting one spar member. Minor adjustment or inspection may be made of the engine compartments through several small trap doors in the under wing surface. If it becomes necessary to reach the engine while in the air, a mechanic may crawl into the wing through small doors leading out of the toilet compartment.

The normal fuel supply of 500 gal. is divided among four tanks carried in the intermediate wing sections outboard from each engine compartment. The tanks are slung in cradles between the spars, and are accessible for inspection or replacement through removable panels in the under-surface of the wings. Engine-driven pumps supply the carburetors of all three engines. Hand "wobble" pumps are also provided for emergency use. A system of distribution valves remotely controlled from the cockpit, makes it possible to feed any engine from any tank; or shut off any tank at will.

Compressed air is used for engine starting. The two outboard engines are each equipped with an air compressor, and air storage tanks are mounted in the wing stubs. Main starter controls are located in the cockpit, but the controls for the usual Hispano type starting spray lubrication are located in a remote control compartment, amidships.



The landing gear

The landing gear design is a compromise between the usual fixed, streamlined undercarriage, and the fully retracting wheels of the Lockheed or Boeing type. It might be well classified as "semi-retractable." When in the air or when on the ground, the wheels may be drawn almost completely into streamlined enclosures hung below the wing engine compartments. This arrangement insures relatively low wheel drag in flight, and accomplishes two important features on the ground. In the first place, it permits the storage of the airplane in hangars of the usual size in spite of the unusually great height of the engine nacelle and propeller, and in the second place, the fact that the fuselage lies close to the almost parallel with the ground when the wheels are in the "up" position, facilitates the loading of passengers and baggage.

When ready to take off, or to land, the wheels are fully extended,—some distance beyond the retracted position. Retraction and extension is done by compressed air under the control of the pilot. Sufficient pressure is available so this operation may be carried out on the ground under the full weight of the

Three-view drawing and dimensions

Span	110 ft. 0 in.
Length	80 ft. 10 in.
Height (loading position)	19 ft. 6 in.
Height (take-off position)	23 ft. 7 in.
Wheel tread	26 ft. 5 in.
Chord at root	20 ft. 10 in.
Thickness at root	4 ft. 3 in.
Wing area (including ailerons)	1,600 sq.ft.
Aileron area (two ailerons)	110 sq.ft.
Fin area	42 sq.ft.
Rudder area	61 sq.ft.
Stbilizer area	130 sq.ft.
Elevator area	102 sq.ft.

loaded machine. In flight, the air pressure is available for positive extension.

The retracting gear is arranged so that the landing wheels may be extended or retracted together or separately. An indicator on the dash board shows the position of each wheel, at all times. A large green bull's-eye on the instrument board is lighted when the wheels are extended. The engine starting system also supplies high pressure air for operating the retracting gear.

This arrangement has an important bearing on maintenance. Ordinarily, wheel "pants" are badly in the way when it comes to adjusting brakes or changing a tire, and much valuable time may be wasted in removing and reassembling them. On the new Ford, however, the fully extended wheel is entirely clear of the fairing, and maintenance operation may be carried out without delay and without disturbing the housing. Removable panels in the strut and radiator fairings give easy access to the shock units and to the radiator connections.

The main wheels and brakes are of hydraulically operated, two-shoe design, and carry 58x14 high-pressure tires. The brake pressure is not applied directly from the foot pedals, but through air-operated "servo" cylinders similar to those used on large buses and heavy trucks, located under the pilots' seats. The high pressure air, which is bled from the engine starting system is toe controlled from a combination rudder and brake pedal.

The location of the tail wheel is somewhat unconventional for land planes. Instead of being attached at or near the rudder post, as it common practice, it is mounted in a well in the under part of the fuselage just aft of the cabin section. This arrangement relieves the fuselage of a portion of the bending stresses in a three-point landing. The wheel and shock struts are approximately the same size as those regularly used on the standard Ford Model 5-AT for main landing wheels. Access to the wheel mounting may be had from inside the fuselage.

Tail surfaces

The tail surface assembly is quite conventional. The fin is built as an integral part of the after-section of the fuselage, and supports the stabilizer and elevators above the top deck line of the fuselage. The fin is fixed, but the stabilizer is adjustable in flight, through a relatively simple worm-gear device housed in the fuselage. Both rudder and elevators are of the balanced type. All tail members are of corrugated Alclad rivetted over duralumin frames.

Cockpit and control

The usual wheel type dual control is provided in the cockpit. Throttles and mixture adjustments are located on a pedestal between the pilots' seats, and the fuel supply and the stabilizer setting are controlled from a small panel mounted over the cockpit doorway behind the pilot. Radiator shutter control, fire extinguisher control, and the starter lubricating system mentioned previously, are all located amidship in the remote control compartments. They must be manipulated by the co-pilot or flight mechanic. A cover locked in place over the control handles prevents wilful or accidental manipulation.

All cable, push-pull rods, bell cranks, etc., are located wholly within the wings or fuselage. Engine controls, flying controls, and engine plumbing run back underneath the cabin floor, sections of which may be lifted out to give complete access for inspection or adjustment. All fuel valve and stabilizer adjustment controls run from the cockpit through the hot-air ducts in the cabin ceiling. The bottom sections of the ducts are removable to give access to cables and pulleys. Every movable connection, hinge, or pulley, is carried on self-alignment ball bearings, which are packed in grease at assembly and should never require attention throughout the life of the airplane.

Engine and navigating instruments are concentrated in a single board in front of the pilots. All dials are indirectly lighted. In addition to the usual assortment of instruments and indicators, a fire alarm signal system has been installed. Quartz bulb thermostats are strategically located about the engine compartments and in case of any unusual rise in temperature a large red glass bull's-eye is lighted on the instrument board. A 32-cp. lamp behind each bull's-eye insures that the signal will be instantly visible even in the brightest sunlight.

Due to the absence of a nose engine, the view forward and downward from the cockpit is excellent. A folding rear view mirror installed in the roof over the cockpit permits either pilot to observe the operation of all three propellers, as well as to check on the approach of other aircraft from the rear.

A wind-driven generator for supplying electric current is mounted on top of the fuselage back of the center nacelle in the slipstream of the propeller.

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Shooting the clouds

The Weather Bureau's clinometer measures their height

AN instrument for measuring the height of clouds above an airport has been designed and developed by Prof. Charles F. Marvin, chief of the Weather Bureau of the United States Department of Agriculture. Its purpose is to measure the angular elevation of a spot of light projected on a cloud at night. It consists of a sighting tube equipped with eye piece and cross wires, to which a quadrant with scale reading from 0 to 90 deg. is rigidly attached. A pendant, pivoted on a horizontal axis hangs vertically of its own weight when the tube is sighted on an object. The zero line on the scale is indicated by the pendant when the tube is sighted on an object at the same level. A small clutch operated by turning a milled head screw clamps the pendant in position after a sighting has been made.

Professor Marvin using the clinometer

To use the instrument, a vertical beam of light is focussed on the overhanging clouds from any sort of projector whose beam may be adjusted to the vertical. An observer with the instrument takes up a position at some known distance from the projector, usually 500 or 1000 ft. By sighting on the spot of light on the cloud, and reading the included angle directly from the scale on the clinometer, the height of the cloud above the horizon may be readily calculated. For any given base line a table may be readily calculated so that the reading of the instrument may be converted quickly from degrees into feet of altitude.

The Weather Bureau is supplying this type of equipment to stations that have projectors, but lack other means of measuring angular height. Instruction sheet and table of altitude for base lines of 500, 1,000 and 1,500 ft. are sent out with each instrument.

EDITORIALS

AVIATION

EDWARD P. WARNER, *Editor*

An aviation platform

(Continued from March)

AVIATION'S platform proceeds finally to its close. In the four months in which it has claimed our editorial pages we have presented some thirty items. None of them have lost anything of their importance over the last three months. Upon some we could speak much more forcefully now than at the time when we first mentioned them.

The platform is for the time being complete, but we are not through with its planks, and we do not expect to let the industry forget them. We shall return to them again and again, individually and in more detail. A year hence we plan to sum them up again, and at that time we hope there will be marked progress to record on at least a substantial majority of the thirty-odd headings.

Manufacturing *(Continued)*

6. Develop an industry policy on the regulation of commercial design and construction. Though the relations between the Department of Commerce and the aircraft industry are notably harmonious, there are many manufacturers who feel grave concern for the future. We cannot rely upon an indefinite continuance in office of personnel of such exceptional experience and gifts as are possessed by Secretary Young and those who immediately surround him. Even if we could, the present system of government control is scarcely capable of unlimited extension in exactly its present form.

In developing a long-term policy of regulation of civil flying, one of four alternatives will have to be accepted. Regulation may be entirely abandoned. It may be maintained on the present lines, with ten or twenty times the present inspection force and annual expense. It may be turned over in part to state and local authorities. Finally, it may be handled, in a gradually increasing degree, by private or semi-private organizations in which the industry itself exerts control.

Manufacturers have done a great deal of lip-service to the ideal of self-regulation of the industry. The trend in most European countries, generally much more devoted to the extension of governmental authority than is America, has been towards the departure of government from the field of aircraft regulation in favor of private control. But when a concrete proposal is made it receives but little sympathy from American manufacturers, who fear it means only that they would have to pay for a supervision which they now receive free of charge.

The Department of Commerce has shown itself, and we believe it will continue, willing to cooperate with manufacturers, operators, and insurers on any reasonable terms. It is time for the industry to begin to look to the future. There are some things that must continue under the Department's control. We anticipate, for example, that the licensing of all pilots by the federal government will be a permanent institution. But there are other phases of the regulatory work upon which one cannot be so sure.

We purposely refrain from taking any position here. It is for the industry to decide what it will do, but we prophesy that unless some definite course is plotted for the future we shall see the control of aviation by the Department of Commerce becoming more and more intimate and exhaustive. It may well be that no one in the Department desires any such consummation, but the inevitable expansive pressure of government and the succession of Congressional demands that "something be done" after every aircraft accident will force them farther and farther into the field. It may be that that is what is wanted, but if not,—if it is felt, as many manufacturers individually express themselves as feeling, that indefinite extension would be very dangerous to the free and sound development of aviation,—then the industry should busy itself with the development of a policy which will provide satisfactory substitutes or supplements for government control.

7. Survey of the use of aviation in industry. There may be some people engaged in building or selling aircraft who still believe that airplanes can be fitted indiscriminately into any kind of a business enterprise. Three years ago it was rather fashionable to suppose that every traveling salesman could travel by air, and that every light truck engaged in long-distance hauling could profitably be replaced by a plane. Most of us have had a great awakening since 1929. Most of us

now realize that the business use of airplanes has to be highly selective.

Some branches of industry need airplanes, and find them almost indispensable. Others don't. We cannot expect that the individual proprietor or manager of a business is going to take the trouble to find out for himself in which category he belongs. We have to be prepared to tell him that we are right.

There have been studies in the past of the industrial use of airplanes, but they have suffered from a scarcity of experimental data. We have enough experience now to do the thing in proper style. An analysis printed in the statistical issue of AVIATION shows more than 200 planes licensed in the names of industrial owners. A large proportion of them have been in service for at least two years. We are equipped now to go ahead with a real investigation, and a classification of the kinds of business in which the airplane can be useful.

AVIATION can of course do a great deal along that line. We have printed a great many accounts of the work of airplanes in many different fields, and we shall continue them.

But even more could be done through the cooperation of the manufacturers. The service department of the company that sells a man a ship almost always remains in close communion with its use. The analysis of experience with airplanes in industry is another cooperative activity, for the Chamber of Commerce to initiate or guide. A really careful survey of the material in hand would save a great deal of waste sales effort in the future, and it would uncover a great many new prospects.

In times like these very few airplanes can be sold by getting the customer all excited and collecting his signature before he cools off, or by presenting him with a collection of highly-imaginative cost figures which any accountant can shoot full of holes. Sales can only be made by finding markets where our arguments are so strong that they will withstand the most critical acid test. As a necessary preliminary to any intelligent and economical sales effort, we need an all-inclusive survey to divide the sheep from the goats among our possible industrial customers.

8. Give sportsmen an incentive to use planes. Whatever may be done to develop the industrial market, its potentialities are small compared with those of private ownership. If, or when, the business of manufacturing airplanes becomes a really vast one, it will be because of widespread private purchases. Even now, the private market is by no means negligible. Even in the desolate year 1931, the sales of planes for private use, absolutely untinged by commercial motives, have approximated $3,000,000. As is pointed out elsewhere in this issue, members of a single aviation country club accounted for $500,000 worth.

But the market has so far been infinitesimal, compared with what it might be. There are hundreds, if not thousands, of Americans who have the money to buy planes, who have the taste for rapid travel and the taste for sport, who are not in the least afraid to fly, but who simply haven't been given any reason for purchasing that appears to them as adequate. Very few of them are disposed to buy an airplane in order that they may keep it at a municipal airport and fly occasionally for the sheer sake of flying.

They want congenial company in their pastimes, and most of them, like most yachtsmen, want the spice of competition. If we are to have a properly growing market for private planes one of our major needs is for the development of more aviation country clubs, or something very like them. Flying needs a new social standing. It needs a gathering-place for those who practice it. It needs, even more than yachting, a club house.

And it needs competition. The air races that have been held in the United States in the past twelve years have, almost without exception, been planned from the point of view of the audience or of the professional pilot interested in winning prize money or enhancing his own standing in his profession. As a general rule, no one has shown the slightest interest in what the amateur pilot would like to have, and not the slightest effort has been made to cater to him. It ought to be the concern of the manufacturing industry to do so, for there could be no better way of stimulating the market.

So far from initiating or cooperating in measures that might give sportsmen an incentive to own airplanes and give the present owners a new interest in using their machines, a considerable section of the industry seems to have gone out of its way to stifle private ownership and to express its contempt for the private owner. The indifference with which the sportsmen pilots have often been treated at great aeronautical gatherings has been notorious. The satirical observations on the "blue-blood" derby at the National Air Races last year were typical. Certain professional pilots, encountering a group of private owners, have been outspoken in their disdain for the amateurs, simply because they were amateurs.

It is somewhat unusual to see a faction in an industry deliberately trying to insult their customers and to alienate their market. Fortunately that particular group is not very large, but it is not sufficient merely to refrain from deliberately antagonizing the potential private owner. He must be sedulously wooed. The industry must give him a reason for ownership, and it must find as many entertaining things as possible that he can do with his airplane after he has bought it.

9. Get more seaplane bases. Seaplanes and amphibions make a particular appeal to the type of sportsman that can afford to fly and that ought to be flying. Unfortunately, however, the typical customer drawn from that class demands convenience of use. At the present time we cannot insure it to a proper degree.

Except for naval stations, there are only a dozen

seaplane bases in a thousand miles of Atlantic coastline. The Pacific fares even worse. Of the few that do exist on the East Coast, the majority are grouped within a hundred miles around New York. The private owner traveling by seaplane ordinarily has to anchor, with great resultant danger to the plane in case of storm. When refueling is necessary, it has to be accomplished from a barge or dock equipped for handling motor-boats, but with no special provision for the fueling of airplanes, and frequently manned by personnel quite unfamiliar with the handling of a plane.

In spite of all the difficulties, seaplane flying has grown in popularity. Its real attractions rise superior to all obstacles. The number of amphibions and flying boats upon the registry has steadily increased. The growth ought, however, to be very much more rapid, and it can be if proper facilities are assured. Municipalities that have provided airports ought to supplement them with seaplane stations. Often the two can be merged, for a number of coastal cities have their airports on water-front land. Yacht clubs near the metropolitan centers can provide an extra attraction for a steadily growing proportion of their members and guests in the form of a seaplane ramp and servicing equipment. If the existing number of seaplane bases can be multiplied by ten with the new ones well distributed along both coasts and on the Lakes, the potential seaplane market can be increased in the same ratio.

10. Work for better agreements abroad. An agreement was recently concluded between the governments of the United States and of Italy, providing that the airworthiness certificates of each country would be acceptable in the other and that a reasonably free international trade in aircraft could therefore be maintained.

The existence of such an agreement ought not to be the subject of special mention. It ought to be taken for granted. Unhappily, however, the Italo-American understanding is very nearly unique. There are only a handful of countries with which we have concluded any general convention upon the subject of licensing. The general rule is that each nation still constitutes an aeronautical island. Theoretically, most countries are willing to license only planes that have been inspected by their own governments during the course of construction, and foreign trade in civil aircraft among the major states is a matter of special dispensation. As an instrument of transport the airplane goes far to break down the significance of international boundaries. As an article entering into world commerce it finds those boundaries magnified to the utmost.

The negotiation of such an agreement of course has to be handled by the government, but the industry, and particularly that part of the industry which has agents abroad, can do a great deal to help out. There have been some American manufacturers who have believed, because of their fear that the foreign manufacturers might invade the American market, in restricting international trade to the utmost. Their attitude is shortsighted, and shows a wholly unnecessary lack of confidence in their own products. We have no fears for the ability of American planes to take care of themselves in any kind of fair competition, but they cannot take care of themselves where governmental authorities have forbidden them even to enter the race. It is definitely to be desired that there should be the greatest possible freedom of international flying, of international air transport, and of the international aircraft trade. The efforts of the Department of Commerce to secure agreement to that end with all foreign countries deserve the whole-hearted support of the industry.

11. Cooperate in foreign markets. When foreign markets have been opened they have to be exploited. No single manufacturer under present conditions can afford to maintain a world-wide sales organization. Occasional "missions" have been sent to various parts of the world by various builders, but they have had to be intermittent, and they have touched only limited areas. In the meantime European countries, and particularly Great Britain and France, have been expanding their foreign trade in aircraft as the result of the activities of governmental or semi-governmental missions, covering a succession of foreign areas and presenting the products of the national industry as a whole.

The precedent established by Great Britain and France deserves very serious study here. We cannot expect, under our system of government, that the Department of Commerce will undertake to organize the demonstration of American products. The Bureau of Foreign and Domestic Commerce is already providing an invaluable conduit for the flow of information about foreign markets to the United States and for the passage of data on American products to the foreign countries. The aircraft industry ought to go further, and to organize a more aggressive campaign to prove the quality of American planes, engines, and accessories. The first requirement is that the foreign markets should be impressed with American products. The competition of American manufacturers with each other is a secondary matter. If our builders go into a foreign market principally to criticize each other's products they will all find their position seriously weakened as against their competition from Europe.

There is an export division of the Chamber of Commerce, which has done very useful work in simplifying the routine of foreign trade, but much more than that is needed. The Webb-Pomerene act specifically permits American industries to form associations for engaging in foreign trade, and to employ cooperative tactics to an extent that would be in conflict with the anti-trust laws if practiced domestically. Either within the ranks of the Chamber of Commerce or through a separate organization newly formed, American aircraft manufacturers should band themseves together for the development of foreign markets and the safeguarding of American aeronautical prestige.

NEWS OF THE MONTH

Air mail hearings

HEARINGS on air mail matters were held by the House Committee on Post Offices and Post Roads March 1-4. Indications are that no substantial change will be made in air mail policy this session, since the committee apparently has been convinced that nothing is seriously wrong and that it would be unwise to attempt basic changes by legislation. Members appear to feel that some of the extensions of contracts were somewhat unwise, but there is no considerable demand for general cancellations.

Two matters brought up in the hearings, receiving primary consideration, are the advisability of an amendment to the air mail act specifying a minimum basic rate of pay for pilots, and a bill requiring that henceforth no extension be made without competitive bidding.

Opening the hearings, Chairman Mead denied any intention on the part of Congress to impose drastic limits on postal aid to the aviation industry. He went on to say, however, that there is dissatisfaction in the Appropriations Committee and in Congress over the methods of awarding contracts. Unless there is a change of policy in this respect the present system of rendering aid to air-...es will be endangered. Congress, said Mr. Mead, clearly expressed its intention in the amended Watres Act that no contract should be awarded without open bidding. He called on representatives of the Post Office Department to draft a bill which would correct the situation and yet not seriously interfere with the present policy.

W. Irving Glover, second assistant postmaster general, frankly admitted air mail could be carried for considerably less than the present appropriation. The issue, as he defined it, is whether Congress wants merely to provide for the transportation of air mail at minimum cost, or to utilize the carrying of mail as an instrument for developing a sound commercial air transport system.

The policy of the Post Office Department is to avoid the award of air mail contracts to "shoestring operators" and to concentrate the air mail business as far as possible in the hands of the larger airlines, Mr. Glover explained. As passenger business increases, the pay for carrying mail is reduced so that eventually the point will be reached when the service will be self-sustaining.

It was emphatically denied by Mr. Glover that some lines are being favored to the exclusion of others in the award of mail contracts. The measure seeking cancellation of all contracts awarded without public advertisement, in his opinion, called for unpardonable breach of faith on the part of the government.

For more control

One committeeman suggested the Post Office Department be authorized to control more closely the equipment and flying personnel of air mail contractors. Others thought the regulations of the Department of Commerce are not stringent enough. Mr. Glover refused to be led into saying anything concerning the Century dispute. He was reminded several times that the Comptroller General has seriously questioned the right of the Post Office Department to award air mail contracts without public advertisement. In response, he declared that every cent payable under contracts has been passed upon and approved by the Comptroller General.

Frank E. Ormsbee, speaking on behalf of the Air Line Pilots Association, doubted that Century could make good on the offer to carry the mails safely at 50 per cent the present cost. The pilots' association includes 75 per cent of the pilots actively engaged in scheduled transport flying in this country, Mr. Ormsbee told the committee, and excellent relations exist between them and all other operators except Mr. Cord. The pilots' association includes 450 men who receive an average pay of $600 a month.

A representative of Century, taking vigorous exception to the testimony presented in behalf of the pilots' association, startled the committee by offering to pay $2,000 a month to pilots if the Cord interests were to be awarded a contract for carrying air mail between Atlanta and Los Angeles at the same rate of compensation as the present contractor. In general, he alleged the difference in pay between Century pilots and other pilots is due to the fact that the other operators are subsidized by the government, while Century must rely solely on the income derived from passenger traffic.

Change in regulation?

On March 2 Col. Paul Henderson, vice-president of United Air Lines, declared the time had about arrived to provide "a miniature interstate commerce commission of the air" to regulate the operations of air transport companies, stating that there are always newcomers in the air transport field who threaten to disrupt established practices. The regulation would limit air transport operations by means of operating certificates. He was asked to offer a plan for legislation that would put a stop to controversy over air mail contracts.

A strong protest was lodged by representatives of the Western Air Service over the award to United of an extension contract that paralleled their service between Omaha and Dallas. It was complained that the action was tantamount to directing Western Air Service to cease operations, since it involved the granting of an unsought subsidy to a parallel line. Permission to turn over the contract to the Western Air Service as a subcontractor was said to have been denied by postal officials.

Col. L. H. Brittin reported the cost of operating Northwest Airways per month is $90,000, while the money obtained from the Post Office Department is $70,000 a month. The revenue received from the passenger traffic just about makes up the $20,000 difference. The company would be unable to render the present passenger service if it did not receive government aid.

J. M. Eaton, president of the Ludington Line, told the committee that his company wanted to establish an air mail

Calendar

May 22-30	International conference of pilots who have made trans-Atlantic flights, auspices Italian Aero Club, Rome.
May 27-30	National Balloon Races and Second Annual Omaha Air Races, Omaha
June 17-19	International Air Pageant, formal opening of Aviation Country Club of Lake Champlain, Westport, N. Y.
June 25	13th Annual Royal Air Force Display, Hendon, England.
July 8-9	King's Cup Race, Brooklands Aerodrome, England.
July 18-31	Third American Soaring Meet.
July 22-31	Third International Aeronautical Meeting, auspices Aero Club of Switzerland, Zurich.
July 28	Pre-Olympic Air Show, San Diego
Aug 1-6	International Soaring Contest, Wasserkuppe, Germany.
Aug. 11-28	International Air Tour, auspices Aero Club of Germany.
Aug. 27-Sept. 5	National Air Races, Cleveland.
Sept. 25 or Oct. 8	Gordon Bennett Balloon Race, Basle, Switzerland.
November	Thirteenth Aeronautical Exhibition. Grand Palais. Paris.

special delivery service between Washington and New York. He suggested a special 25-cent stamp for super-special handling.

The hearing closed March 4. John Kohler, president of Kohler Aviation Company operating across Lake Michigan, said his company would like a mail contract but was afraid to broach the subject lest competitive bidding open the way for another operator to drive his concern out of territory it had developed. Temple Bowen of Bowen Airlines stated his company's passenger service costs 20 cents per mile to operate, and that a mail contract at 25-30 cents per mile would be satisfactory.

Century dispute continues

The dispute between Century Airlines and the Century pilots has dragged along without any shadow of a settlement. Century in the first few weeks encountered an unexpected dearth of qualified pilots in response to its appeal for applicants. Schedules were upset for more than a month, and night schedules have not been resumed, as AVIATION goes to press. The dispute between the company and locked-out pilots was carried to Congress and the Chicago city government, with the balance of Congressional sympathy with the pilots. A flood of publicity, including violent attacks on the patriotism of the pilots and on the veracity of Mr. Cord, has issued forth from the headquarters of both parties.

The disaffection did not spread to Century Pacific, which began operating eastward in El Paso in February. On March 12 it lost its petition for a certificate of necessity and convenience from the state of Arizona. American Airways had objected strenuously on the ground Century Pacific was competing in territory American had pioneered. The commission ruled Century's service not necessary at the present time. On Feb. 11 Century Pacific's planes were heavily patronized by passengers transferring from trains held up by snow in the Techachapi mountains.

Varney operates Air Ferries

Varney Air Ferries has begun operating the service which it took over from Air Ferries, flying nine round trips daily between San Francisco Bay and Oakland. Connections are made with the Varney Speed Lanes planes operating between Los Angeles, Sacramento and San Francisco.

Pan American has issued a traffic report for 1931 stating that passenger traffic jumped about 17 per cent over that for 1930. A total of 40,676 passengers were carried in 1931 as compared with 34,748 passengers the year before. Mail poundage increased 95,184 lb.

Pan American and American Airways have reduced passenger fares.

New airline division

American Airways has consolidated the Embry-Riddle and Universal divisions into the new central division. Headquarters are at St. Louis under the direction of Col. Halsey Dunwoody, vice-president. His staff includes Earl Ward, operations manager; Charles S. White, general traffic manager; F. D. Hoyt, superintendent of maintenance; Ben Bell, superintendent of overhaul. John Paul Riddle, formerly general manager of the Embry-Riddle division, has been transferred to the New York offices as head of the operations department for the entire company. Routes and schedules continue as before. The company's New York terminal has been changed from the Pennsylvania Hotel to the Hotel Commodore. Pilgrims have been placed on the New York-Montreal run, giving passenger service daily except Sunday. The fare is $23.39 one way, a rate of 7 cents per mile.

Wide World

ANOTHER RECORD

Miss Ruth Nichols receives from Charles H. Gale, assistant editor of Aviation, official observer, the barograph which showed she flew a diesel-powered Lockheed to a new altitude mark for that type of engine

Transcontinental & Western Air has discontinued temporarily two of the daily flights between St. Louis and Columbus and the afternoon service between New York and Pittsburgh.

All the domestic contract mail operators now are members of Aeronautical Radio, Inc., with the recent addition of United States Airlines, Pennsylvania Airlines and Transamerican. The work of equipping domestic lines with radio facilities is nearing completion, the latest order for equipment being one for $50,000 worth of radiophone sets from the Western Electric Company for completion of the installations on Northwest Airways system.

Northwest has successfully provided passengers with individual radio service tuned in on commercial programs during flight; now American Airways has adopted the same idea. The first of its machines so equipped has been turned out at the Dallas shops, others will be fitted out as they go through the shops for overhaul.

Air mail in India

Imperial Airways is encouraged by the fact that business men in southeastern India and Burma have asked that permission to use Dutch and French mail planes for the transmission of intra-India mail. The two foreign companies have been permitted to cross India but not to pick up any mail in that country. Imperial Airways has been kept out of India altogether, except for the operations at Karachi, because the Indian government wishes to develop the intra-India services itself. The demand of business men for permission to use the foreign services indicates a demand may follow for concessions to Imperial Airways.

A sum of $250,000 has been made available, from a fund established some time ago for the development of railways and other means of communication between Cairo and Capetown, for improvements in airport, meteorological and communications facilities along the Imperial Airways route in Africa.

Corporation Aeronautica de Transportes temporarily suspended its Mexico City-El Paso and Brownsville-Mazatlan services Feb. 10. The suspension was approved by the Mexican Ministry of Communications, which recently inaugurated periodical inspection of all air transport companies and their equipment operating in Mexico. Cia. de Transportes Aereos Mexico-Cuba has started a daily mail, passenger and express service between Mexico City and San Antonio, Kingbirds are used, the fare is $45 one way.

Japan Air Transport has been operating a Junkers between Mukden and Harbin to test traffic conditions with a permanent service in view. French and Belgian interests continue their ground work for the establishment before autumn of their proposed joint air service from Europe across central Africa. The Spanish government-subsidized airline has been liquidated by the new republican government.

Mail speeded up

Transcontinental & Western Air has reduced its 25-hour mail service between Los Angeles and New York to 22 hr. 42 min. Mail leaves Los Angeles at 7 p.m. instead of 3:05 p.m. and will reach

New York at 8:42 p.m. the following day, instead of 8. The west-bound trip is flown in slightly under 24 hours, as before. The faster eastbound schedule was achieved by reducing waiting time at points of call.

Civic organizations in the Southwest have sought for reinstatement of the Western Air Express night service between Los Angeles and Salt Lake City, which was cancelled when mail was routed to the T. & W. A. high speed night service. T. & W. A. now also gets some mail for points on the southern route flown by American Airways, causing the rival companies to plan faster equipment and tighter schedules.

Airport operators of Rhode Island have organized an association for coordination of their interests. Seven companies are represented. A-1-A ratings have been awarded the El Paso, Douglas (Ariz.) and Wold-Chamberlain (Minneapolis-St. Paul) airports. A bill has been introduced in Congress to appropriate $7,000,000 for the improvement of 26 Air Corps fields.

Wings over China

Cessation of hostilities on the Shanghai front and a deadlock in peace negotiations finds the Japanese air arm at leisure to erect hangars and other equipment for permanent occupation on their recently established landing fields near the city. Some 130 amphibions, about half the Japanese naval airplane strength, and 70-100 army aircraft have been reported assembled near Shanghai. The resisting Chinese air strength of between 16 and 25 planes located at airports around Hangchow, 100 miles southwest of Shanghai, was effectively dispersed by fleets of fifteen and twelve Japanese bombing and pursuit planes in a series of raids on Feb. 27. Since then Japanese aerial activities have been limited to the demolition of the Shihtzelin and Woosung forts and small expeditions against Chinese troop movements.

Some explanation of the dearth of Chinese aircraft on the Shanghai front is offered by the apparent fact that only 70 airplanes have gone from the United States for the use of the Chinese army during the past two years, 40 Vought Corsairs and 30 Douglas observation planes. Some of these may have been among the 200 planes confiscated by the Japanese at Darien.

Ever since hostilities began rumors have been rife of highly profitable positions on the Chinese air force awaiting experienced foreign pilots, but most of the young Americans and Canadians who acted upon them found Chinese authorities uninterested in their services. Made despite national legislation against participation in foreign wars, an offer of their services by a group of Royal Canadian Air Force officers about to be dismissed as a result of government economies has so far been equally unsuccessful. Only Robert Short, an American pilot who had been connected with an American firm in Shanghai for some time, was accepted for service. In a Boeing pursuit plane recently demonstrated to and procured by the Chinese army he attacked three Japanese bombers. Attacked in turn by three pursuit planes, Mr. Short became involved in a prolonged battle in which he was killed.

Wide World

ON SHIPBOARD

A French naval plane about to engage a transverse cable on the deck of an aircraft carrier.

The Navy plays at war

Not in any way weakened by the struggle to take the Hawaiian Islands in the recent Pacific war games, which resulted practically in a draw, the Blue fleet steamed eastward in an attempt to secure a foothold on the West Coast. In six days and nights of flying over Hawaiian waters by 334 Army and Navy planes three forced landings were made due to engine trouble. Two planes suffered minor damages and two were lost at sea, but there was no loss or injury to any of the personnel. While the war off the West Coast is largely a naval affair, aircraft still take an important part, operating from the aircraft carriers of which the Saratoga is the Blue mainstay, while the Lexington and Langley are on the side of the Black "defenders."

Most spectacular episode of the "war" was a general aerial combat between Black and Blue fighting planes. The umpires adjudged 24 of the Lexington's 72 planes to have been destroyed, together with several cruisers and destroyers. The Lexington itself was badly damaged by theoretical bombing, but not until her air forces had "sunk" the Saratoga. The aircraft carriers were primary objectives in all air attacks in major force from either side.

Another novel training event was the first cross-country flight in formation at an altitude of 20,000 ft., made from Selfridge Field to Washington, D. C., by the 94th Squadron, with Wasp-powered Boeing pursuit planes at an average speed of 200 m.p.h. Formation flights have been made to a height of 28,000 ft., but distance flying at such altitudes is unusual.

Akron wins, then loses

Fully exonerated of charges of faulty materials and weakness in its construction, and given a clean bill of health by the House Naval Affairs Committee, the U.S.S. Akron received another blow from which its recovery may be less prompt. While the Committee stood by, waiting to be taken aboard for an all day flight, some part of the handling gear gave way in a strong gust of wind and the stern, swinging free, bumped along over the ground, causing considerable damage to the lower fin and incidental damage to the hull structure just above it. The structural integrity of the airship has not been impaired, however, and repair work is being rushed so that it may participate in the finale of the naval maneuvers off the Pacific Coast. This was the first occasion on which other than purely superficial damage had occurred in the docking of an airship at Lakehurst.

Wind also played havoc with the nonrigid Goodyear dirigible Columbia, causing a crash near Flushing, Long Island, in which one man was killed.

With an eye to the completion of the ZRS-5, sister ship of the Akron scheduled for February, 1933, the Navy Department is letting bids for the completion of its West Coast dirigible base at Sunnyvale, California, which is to be the home of the new airship. Administration buildings, barracks, a helium repurification building, and a 2,000,000-cu.ft. low pressure helium holder which will supplant the structure at Akron as the largest helium holder in the world, remain to be constructed.

With the completion of the ZRS-5, to be christened Macon, so nearly in sight, the future of the airship industry in this country depends largely on the action

of Congress on the merchant airship bills introduced in the House and Senate by Congressmen Crosser and McNary. Though the ship construction loan feature of marine legislation is not included in either bill, both would fix the legal status and liabilities of airships as carriers and permit mail contracts on the same basis as steamships.

The International Zeppelin Transport Corporation, associated with the Goodyear Zeppelin Corporation, declared itself willing to operate inter-continental airship services on mail contracts yielding an average of $17.50 per mile flown. The company would count on 25,000 passengers per year, at $750 each. The airships planned for commercial use would have a lifting capacity exceeding that of the Akron by 15 per cent, would carry 80 passengers and 20,000 lb. of mail. The War and Navy Departments urge the approval of the bill, but the current pressure for economy makes favorable Congressional action very doubtful.

Advocates of the plan proposed by Representative Byrns of Tennessee to combine the War and Navy departments in a Department of National Defense find strong encouragement in the action of the new French government under Premier Tardieu, which combined the ministries of army, navy and aviation into one ministry of national defense under Andre Francois Pietri. Actually, M. Pietri will concern himself mainly with supervising the defense budget and serving as a liaison between the services and the French parliament, while General Weygand, in his capacity of Inspector General, will handle the technical functions of the ministry.

A strongly advocated five-year plan for further development of French continental and colonial air enterprises calls for about $160,000,000. The Chamber of Deputies saw fit to appropriate about $7,000,000 for civil aviation equipment during the coming year. Of this about $3,000,000 will be used for airports, chiefly Le Bourget (near Paris) and Marignane (airport for Marseilles), two and a half million will be devoted to equipment and instruction at government laboratories and workshops, and a million and a half go for the construction of trans-oceanic seaplanes.

While numerous other bills of aeronautical interest have been introduced during the current session of Congress, practically all, including appropriation bills, are still under discussion by the committees concerned. The House Naval Committee has recommended a measure reducing the enlisted men serving as pilots from 30 to 20 per cent of the total flying personnel, but it has not yet been put to vote.

Stick control finale

Several cases long under dispute in various courts have received final judgment. A suit brought by Robert Esnault-Pelterie, French airplane designer and rocket enthusiast, against the United States government and Chance Vought Corporation in 1924 and reopened last fall (see AVIATION, November) was recently dismissed in the U. S. District Court in Brooklyn. The court denied the infringement of his stick control patents on three points; the lack of novelty in the stick control, the fact that the patents do not describe the device as now used, and the lack of evidence in the designer's own planes, neither of which were reported as having flown longer than ten seconds. This brings to a close a case which if successful might have caused immense embarrassment to airplane manufacturers, stick control being practically universal.

Financial reports

Prominent among the companies reporting profitable operation during the past year is the Douglas Aircraft Company, Inc. Net profits after charges and Federal taxes were $549,331, or $1.60 a share on 342,403 shares of stock outstanding, as compared with $689,849, earning $2.02 on each of 341,086 shares in 1930. An additional profit of $79,814 credited to capital surplus, was derived from purchase and sale of the company's own shares.

United Aircraft & Air Transport also showed a net income only 20 per cent inferior to that of 1930. Net operating income was $2,712,570, after a depreciation of $2,833,550; total operating revenues, $27,752,650, as against approximately $30,000,000 in 1930 and $31,400,000 in 1929; the final net income after preferred dividends, $1.04 a share on the common stock as against $1.28 the previous year.

North American Aviation, Inc., and its subsidiaries, notably the Sperry Gyroscope, B-J Aircraft Corporation, and Eastern Air Transport, report a net income for the year 1931 of $301,819, equal to 14 cents a share on 2,118,959 outstanding shares, against a profit of $1,911,110 or 91 cents each on 2,100,000 shares in 1930. The debility of the stock market was responsible for losses of $714,941 in security transactions during the year, which were charged against the earned surplus account. The board of directors of the company has been reduced from 45 to 24 members.

Western Air Express Corporation and subsidiaries report for the year just past a net profit of $193,382 after depreciation, interest and other charges, but before deducting the company's proportion of the losses of Transcontinental and Western Air, Inc. which were $90,666 compared with a loss of $895,059 in 1930. In 1930 Western Air Express losses totalled $200,670.

In anticipation of the spring season come several notices of new headquarters and new organization plans. The Viking Flying Boat Company recently transferred its manufacturing, storage, service and school activities to new quarters on the New Haven Municipal Airport where they will be considerably facilitated. The Kellett Autogiro Corporation, heretofore known as Kellett Aircraft, also announce a removal of their general offices, including sales and engineering departments, to the Philadelphia Airport.

In direct contrast to current consolidations is the program of distributor expansion being followed by Nicholas-Beazley. This organization, which has been dispensing aircraft and accessories since the post war period, recently arranged for a new distributor company with headquarters at San Antonio to cover the Texas territory. Another branch was opened at Floyd Bennett field the middle of January, with a $75,000 stock.

TO WILBUR WRIGHT

The monument dedicated Jan. 30 at Pau, France, on the anniversary of the opening of a flying school there in 1908.

Engines developed

A newcomer in engine fields is the R-670 by Continental. Rated at 215 hp. at 2,000 r.p.m., the new engine has its A.T.C. and will appear as standard equipment in five 1932 aircraft models.

A similar portion of the British aeronautical field should be covered by a new six-cylinder light airplane engine produced by D. Napier & Son. Their six-in-line inverted engine of 150 hp. weighing about 3 lb. per hp. has had considerable bench testing and is to have its aerial tryout in a British Spartan plane.

Pratt & Whitney Wasps, their reliability proven to the K. L. M. during more than twelve months of regular service under the various climatological conditions of the Amsterdam-Batavia airline, will power the five three-engined monoplanes which the Dutch airline has ordered from the Fokker works in Amsterdam. The type ordered is slightly larger than the plane now in use on this route and will bring the cruising speed up to 125 m.p.h., about 12 miles better than the present schedule. The K. L. M.'s engine department at Rotterdam has been conducting comparative flight and bench tests of 575 hp. Curtiss-Wright Cyclones and P. & W. Hornets for use in twin-engined Fokker, but the work has not yet passed the experimental stage.

A news item in the March issue incorrectly described the Martin bomber recently delivered to the Army Air Corps as having Hornet engines. It is powered with two Curtiss-Wright Cyclones.

The already wide sphere of operations of de Havilland aircraft has been further extended by recent orders and licensing arrangements. The Tiger Moth in the future will be built in Norway in the State Military Aircraft Factory at Kjeller, though the Gipsy III engines with which it is powered will continue to be imported from England. Fifteen Moths have been acquired by the Brazilian government for use by its army air service. The first order placed by the Brazilian government in the British airplane market in some time, a connection with the air display at the British Empire Trade Exhibition at Buenos Aires last year is apparent.

The accuracy of the sonic altimeter was well demonstrated in recent tests on the navy dirigible Los Angeles. When passing over the George Washington Bridge at an altitude of about 3,000 ft. the instrument recorded two distinct echoes for each sound, one from the bridge and another from the water.

In a semi-rigid airship built solely for demonstration purposes an Italian engineer, Sr. Forlani, has incorporated an entirely new system which makes possible maneuvering in any direction without discharge of ballast or gas. Two fans connected with the engine, blow air through two tubes, connecting with two groups of valves, one at either end of the ship. The current of air through these valves, which operate either independently or in combination, moves the airship in any direction on a horizontal plane, and, within certain limits, in the vertical.

The successful development of an idea almost as old as the airplane itself, and on which Professor Hele-Shaw has been working in England for many years seems in sight. He has developed a propeller of automatically variable pitch which has stood up under more than 150 hours flight testing. The mechanism has been adapted for leading British aircraft engines, and has already been acquired by Japan and the Soviet Union.

A device which should win the approval of the parachute advocates busy in several legislatures is being developed by the Army Air Corps at Wright Field, Dayton. It provides an 85-ft. parachute which can lift an especially constructed cabin intact from a falling plane and lower it gently to the ground. Experimental work under the direction of Maj. E. L. Hoffman has so far proved successful. Test of a plane chute recently made at Lansing, Ill., ended disastrously when one of two parachutes intended to lower the entire plane to safety failed to open.

Soaring meets arranged

The annual international soaring flight competition will be held at the Wasserkuppe in Germany during the first week of August under the auspices of the International Commission for the Study of Motorless Flight. Each country will be limited to three participants. Nations now represented in the work of the Commission are Germany, Belgium, France, England, Italy, Holland, Switzerland, the Argentine and the United States.

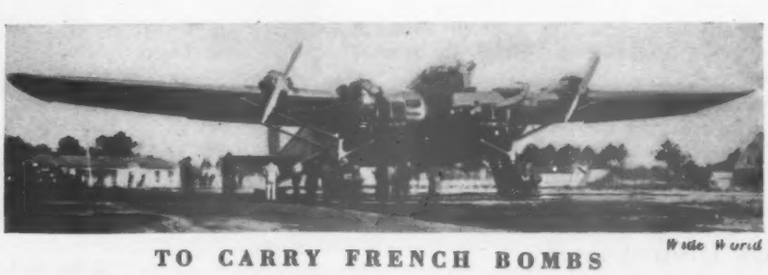
An association of well-known soaring pilots and others interested in gliding and soaring in this country was projected in New York City late in February to arrange for a third annual soaring competition this summer. July 18-31 was chosen as the probable date and Elmira, N. Y., the site of the last two annual meets, was tentatively selected for this year. Warren E. Eaton and Edward P. Warner were elected president and chairman of the board of directors, respectively.

Victory in the National Balloon Race at Omaha brings with it the Litchfield Trophy and a place on the United States team for the Gordon Bennett international competition. Since no international race was held in 1931 the contest committee of the National Aeronautic Association is considering allowing the winners of the last national event also to compete in the Gordon Bennett race to be started Sept. 25 or Oct. 2 from Basle, Switzerland.

Switzerland is also to be the scene of the third International Aeronautic Meeting, to be held at Zurich July 22 to 31. Sponsored by the Aero-Club of Switzerland the meeting, whose predecessors occurred in 1922 and 1927, will feature events for commercial as well as military and sport planes and speed contests. As is usual at continental meets the event for sporting or light planes will be preceded by extensive technical trials as the basis for handicaps. Points are given also for self-starters, fire-extinguishers, and other equipment for the convenience of the pilot. The formulae upon the basis of which the cash prizes of 40,000 Swiss francs, and six trophies are to be awarded are, if anything, even more complicated.

Prince George Bibesco of Rumania, president of the Federation Aeronautique Internationale, whose last flight into the East ended in a crash over British India, is planning an extensive trip through Africa to find a new route for a direct crossing of the Sahara and thus shorten the trip from France to Madagascar. To pilot the tri-motored Junkers transport plane powered with 500-hp. Hispano engines Prince Bibesco has invited Capt. Dieudonne Coste, who is at present engaged in blazing a new trail from Tchad to Tunis across unexplored portions of North Africa. In the event of his being unavailable by March 15, the date set for the take-off, Paul Codos, recent Paris-Hanoi flier, will take his place at the controls.

In the cause of German trade and the German meterological service a Junkers W33 seaplane recently started eastward under the command of Capt. Otto Bertram. He plans to visit Persia, India, China and Japan and possibly the



Wide World

TO CARRY FRENCH BOMBS

The new S.A.B.20 four-engined bomber recently turned out at Bordeaux. It can carry 5,000 lb. of bombs and is armed with three machine guns.

United States, if plans for a round-the-world flight materialize.

Trophies and medals

Now apparently is the time for the outstanding areonautical accomplishments of the past year to receive due recognition in the form of trophy or medal. The L. S. Thompson Speed Trophy, secured by the Royal Air Force in 1929 with the world speed record attained in that year by Squadron Leader Orlebar, remains with that organization through the new record of 406.997 m.p.h. established by Flight Lieut. G. H. Stainforth at Lee-on-Solent on Sept. 29, 1931. Formal presentation of the award was made by Senator Hiram Bingham, president of the N.A.A., to the British ambassador for Lieut. Stainforth. The Trophy, awarded only for breaking the world's maximum speed record, was donated in 1928 by a group of 30 Naval Reserve officers, most of whom served with the Yale Naval Unit, in honor of Col. Lewis S. Thompson, and should not be confused with the Charles E. Thompson Trophy presented each year to the winner of the outstanding free-for-all speed event of the annual National Air Races.

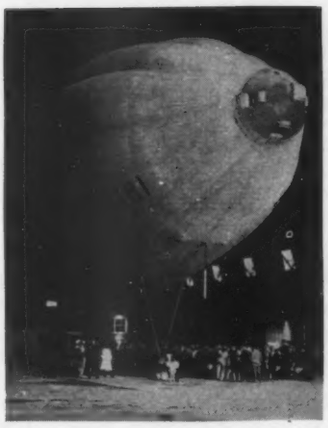
Bert Hinkler is the recipient of the Britannia Trophy for his solo flight from New York to London, considered by the Royal Aero Club the most meritorious flying performance of the year.

At the recent F.A.I. conference in Paris the F.A.I. altitude requirement for airplane speed record trials was raised from 164 to 246 feet, as a result of the fatal crash of Lowell Bayles while attempting to raise the American mark.

The second attempt of the N.A.A. to secure recognition for the achievement of Post and Gatty, following the award of the F.A.I. gold medal to Doctor Eckener, promises to be more successful. A resolution introduced by Senator Hiram Bingham to authorize the President to award them gold medals in recognition of their round the world flight has been passed by the Senate and is now before the appropriate House committee.

A 200-mile flight by Guenther Groenhoff, German holder of world soaring records, in a tail-less plane, was rewarded by a Berlin newspaper. The all-wing plane, powered by a 24-hp. engine and designed by Alexander Lippisch, made the trip in less than two hours.

The flight of the year thus far was made from Hanoi, French Indo-China to Paris Jan. 21 to 24 by MM. Codos and Robida in three days, four hours, and 55 minutes, bettering by a day and some seven hours the record made in 1929 by Costes and Bellonte, who had themselves broken the record established by Nungesser and Coli a year before. Their Hispano-powered all-steel plane, product of the Breguet factories, as was the previous holder of the record, covered the 6,840 miles in about 66 hours flying time. A military plane of reconnaissance type, on this trip a 380 gallon auxiliary tank took the place of its more usual load of bombs, bringing the cruising range up to nearly 2,000 miles.



NOVEL NOSE

Showing the unique valves fitted on the new Italian semi-rigid. Other valves are in the tail.

Further proof of the efficiency of the diesel engine is the new altitude record set by Miss Ruth Nichols at Floyd Bennett Field on Feb. 14. The barograph carried in the diesel-powered Lockheed Vega when calibrated by the Bureau of Standards for the N.A.A. showed a height of 19,928 ft., some 500 ft. higher than the altitude its owner, Clarence Chamberlin, had reached several days before (AVIATION, March).

Personnel

Frederick G. Coburn, president of the Aviation Corporation during its period of development under the guidance of the firm of Sanderson & Porter, has resigned to give place to a permanent management. LaMotte T. Cohu, of Myron S. Hall, Inc., long a member of Aviation Corporation's Board and chairman of the Board of Air Investors is the new president. First announcement of the new president denied the rumored sale of American Airways, air transport subsidiary of Aviation Corporation, to E. L. Cord. The promotion of friendly relations between the two companies has been the subject of conversations, giving rise to the rumor.

Walter Beech has announced his resignation as vice-president of Curtiss-Wright Corporation and president of the Curtiss-Wright Airplane Company. He expects to continue active in aircraft manufacture, under his own auspices.

John S. Allard, president of the Curtiss-Wright Flying Service, has extended his activities to become vice-president in charge of sales for the entire Curtiss-Wright Corporation.

E. W. Dichman, former Chief of the Airplane Section of the Material division of the Army Air Corps and Chief Engineer of the Fairchild Airplane Manufacturing Company, now American Airplane and Engine Corporation, is now with the Chance Vought Corporation as consulting engineer.

Walter H. Sandt, Jr., for several years identified with the air transportation as air traffic engineer with Aeronautical Chamber of Commerce, North American Aviation and the Aviation Corporation, has been appointed as Air Traffic Manager for Postal Telegraph.

N. N. Tilley, formerly of American Airplane and Engine Corporation, is now chief design engineer of the Continental Aircraft Engine Company.

Leland F. Schoenhair, winner of the Los Angeles-Cleveland non-stop flight to the air races in 1929, is now pilot for American Airways.

H. T. Vane, C.B.E., has resigned his offices as managing director and chairman of the board of D. Napier & Sons, Ltd.

WITH the death of Colonel Thurman H. Bane the aviation industry lost one of its earliest and most active champions. During his command of the Army research and development base at McCook Field, Dayton, during and immediately after the War, great strides in technical advancement were made, notably in cantilever monoplane, the all-metal plane, the wooden monocoque fuselage, and such radical developments as exhaust-driven super-charging, and inverted-in-line and radial air-cooled engines. After his resignation from the Army he became one of the moving figures in the organization of The Aviation Corporation and American Airways which he continued to serve, in the capacity of executive vice-president. until his death.

Statistical error

A regrettable error occurred in the financial record of aeronautical companies on page 117 of the March issue. The 1930 and 1931 figures for the Wright Aeronautical Corporation were confused. The figure for the entire year of 1930 is correct, but losses for the first nine months of 1931 should be $23,548 instead of $1,932,189, the 1930 losses for the same nine months' period. Similar confusion resulted in the statement of Curtiss-Wright losses as $7,159,255, the 1930 figure, instead of $2,139,388, the correct amount for the first nine months of 1931. Corrections also apply to the curves which accompanied the table.

Annual index

The annual index of AVIATION for Volume 30 (January to December, 1931) is now ready. Copies may be secured by writing to the Circulation Department, AVIATION, 330 West 42d St., New York City.

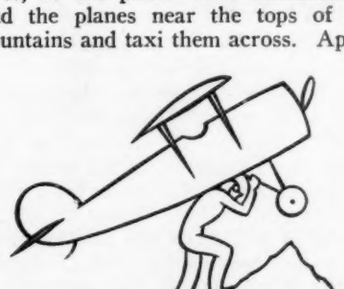
SIDE SLIPS

By Robert R. Osborn

DURING the last few years, aeronautical mergers, combines and exchanges had been going on at such a hectic rate that we finally gave up trying to keep track of them. We had attributed this to our inexperience in stock market matters, but now we are somewhat startled to find that even the bankers had gotten tangled up a bit, and weren't exactly sure what cards they were holding. We quote from a financial statement just issued:

"Through inadvertence the annual letter to stockholders dated Feb. 17, 1932, contained the financial statement of Interplanetary Transport, Inc., without including therein the accounts of its subsidiary, Jupiter-Mars Air Lines Company. We are now enclosing the Consolidated Income and Profit and Loss account of Interplanetary Transport, Inc., and its subsidiary, Jupiter-Mars Air Lines Company, for the year ending Dec. 31, 1931, and Consolidated General Balance Sheet Statement for the same date."

There was some discussion of airplane performance in a recent issue in which we mentioned the story of the airplane which had to be delivered to a South American country, after being built in the United States. After the planes were well on the way (so the story went) it was discovered that their ceiling was less than the mountains they had to cross, so the pilots were instructed to land the planes near the tops of the mountains and taxi them across. Appa-

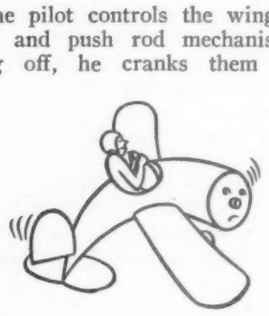


rently this sort of thing was not so unusual as we had thought, judging by a clipping from the San Diego Union, sent us by W. A. McF. of San Diego.

"From St. Elena to Quito, only 150 miles, took three days, for the Andes mountains had to be crossed and the plane had to be carried to an elevation of 17,500 ft. to do it."

You may remember our discussion of the amazing new Russian airplanes in the February issue, our comments being based on the report in the New York *Times* about the new Soviet design, on which "The distance between the wheels and the landing gear is seventeen and one-half feet." Mr. R. C. McK. writes in to give us some more information on what is probably the same airplane—the information being obtained from the New York *Sun* in this case: "Civil aviation authorities today announced the opening on Aug. 1 of one of the longest passenger and mail airplanes in the world, extending 6,000 miles from Moscow to Irkutsk and Vladivostok."

"The pilot controls the wings by a crank and push rod mechanism. In taking off, he cranks them to the



maximum point, locks the crank and allows the plane to drift homeward." Description of a new "fool-proof" plane found by D.S.S.

Pilots often complain about getting all worn out from holding rudder—trying to keep their planes from heading back to the home hangar, and they'll be glad to know that a crank and push rod mechanism might help out.

For some unaccountable reason, when the aviation boom struck camp a few years back, literally thousands of people became obsessed with the idea of carrying an electric stove in an airplane for the first time in history, and that record was being reported to us from all sides for years. We did our best to set matters straight, but the terrible effect this peculiar mania had on people in aviation is apparent even today,—now that airlines have become big business, they are still carrying them, but they are getting lost in transit, of course. The copy of the following letter, sent out by one of the larger air lines, was called to our attention by T.G. of Chicago: "We wish to apologize for a mix-up whereby we have materially delayed a missent package which went to our Chicago field and was forwarded on to Cheyenne before the correcting wire was received. The package got into our stock room and because of the marking showing as phones, it was opened and then the merry hunt began to get it started back. Everything went wrong and even when it was packed and ready it didn't get into the service desk and hung over two planes. Sorry, and will try to do better next time. The material in question is 5 D-89862 "Agitating Transformers," whatever those may be."

We have always pointed with pride to the Department of Commerce, Aeronautics Branch, as at least one govern-

ment group against which there wasn't even the silghtest suspicion of corruption. However, Mr. V.D.B., Jr., of Livermore, Cal. has sent us an advertisement from a contemporary aeronautical magazine which implied the possibility of serious charges against the Department, but we are hoping that the inevitable Congressional investigation will clear their hitherto unbesmirched record. The advertisement, appeared in the classified "Airplane for Sale" section and read: "Cessna, with Axelson motor, completely recovered, just relicensed at a very reasonable price. Look ship over and make offer."

Possibly its spring fever that has us in its grip—maybe we are affected by a too long exposure to the depression—in any case, whatever the cause, our outlook hasn't been of the cheeriest lately. So, we are inclined to disagree radically with a statement we read in a recent report on airfoils: "It follows that the induced drag coefficient is small at low values of the life or at high speeds."

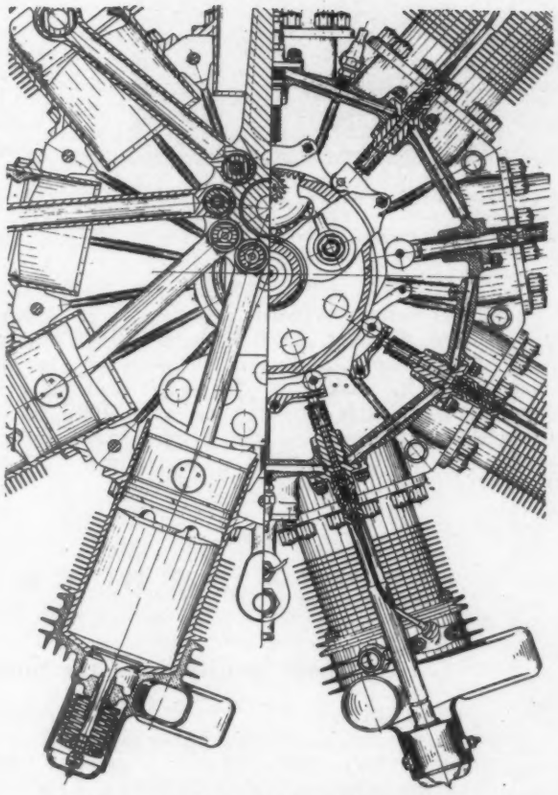
Our hangar flying department

APPARENTLY life as a sailorman tends to give one a very hearty appetite—at least we have information leading us to believe that this is true at least of the aircraft carriers in Navy service. Edward Noonan, field engineer for one of the large airplane and engine manufacturing groups, was a guest of the Navy during one of the cruises of the Saratoga; and the first night was invited to dine with the chief petty officers. He reports that he innocently reached out to acquire a portion of steak from a plate which was placed in the center of the table, and the chap next to him stuck a fork into the back of his hand, put it on his plate and had gravy on it before Ed could pull it back.

FLYING EQUIPMENT

Guiberson diesel engine

DURING the 1931 aircraft show at Detroit, a new aircraft diesel engine was exhibited by the Guiberson Diesel Engine Company, of Dallas, Tex. During the year that has intervened the engine has undergone extensive testing both on the ground and in the air, and is being exhibited in commercial form in this year's show. In external appearance the engine resembles a standard radial air-cooled type very closely, and many structural details are also similar. The crankshaft, master rod assembly and crankcase are of conventional design, but with an increase of from 7 to 10 per cent in weight over the average to take care of the increased loads and pressures encountered in diesel power. The engine operates with a compression pressure of 460 lb. per sq.in., while the explosion pressure is somewhat under 1,000 lb. per sq.in.



Partial section of the Guiberson diesel

Each cylinder has a single poppet valve in the head which controls the entrance of incoming air and the discharge of exhaust gases. Cam-driven fuel pumps mounted directly behind cylinder supply the oil under pressure to the injection nozzles at the proper time in the circle.

The valve cam is mounted in the conventional manner on the crankshaft in the rear part of the case, driven by an intermediate gear at one-eighth crankshaft speed. Since the valve action is somewhat different from standard practice, due to the fact that only one valve is used for both the scavenging and intake, the four valve lobes are exceptionally long as the valve must be held open for some 440 deg. of crank travel. The fuel pump cam is integral with the valve cam and also has four lobes so spaced to give the proper injection time.

Working on the fuel cam are nine roller type followers, each actuating a fuel pump and so arranged that the length of pump stroke is under control. The fuel pumps are mounted in the rear case in line with the pump levers. The fuel is supplied through drilled ducts which bring the oil to crankcase temperature before injection. From the pumps the oil passes through check valves and into open type injectors at the combustion chambers. Each injector is located in the cylinder head, and is easily dismantled for inspection and cleaning.

As piston clearance is very small each piston head is counterbored to permit the opening of the valve. The head is also grooved in line with the injector nozzle to allow the fuel spray to penetrate the combustion chamber. The air inlet manifold is designed to cause a whirling motion of the air on the suction stroke, and the irregular shape of the piston heads adds to the turbulence during compression. The intake port opens forward to receive the air, and is set at the proper angle to utilize maximum pressure of the slipstream. Exhaust port is to the rear and on the opposite side of the cylinder head. Baffles are arranged to assist in cylinder scavenging.

One of the most interesting features of the engine is the method of control. By means of one manually operated lever, the stroke of the pump is varied as the time of the injection is advanced or retarded. The duration of the injection is changed in proportion to the amount of fuel pumped and the time of the injection. By moving the control to the extreme position below the idling point, the air valves are held open and the engine compression is totally released. This decompression introduces a sort of "free wheeling," which permits the propeller to turn freely in a glide with the engine dead. The engine may be started again from a normal glide by merely advancing the throttle. Decompression is also of vital importance in facilitating an inspection and servicing of the engine.

The engine is to be offered in two sizes; the first of 185 hp., weighing a total of 510 lb., and the second, of 240 hp., weighing 540 lb. Detailed specifications for the larger of the two are not available, but the manufacturer has furnished the following general specifications for the 185-hp. engine: Number of cylinders, 9; rated horsepower, 185 at 1,925 r.p.m.; weight, 510 lb.; weight per horsepower, 2.74; outside diameter, 46⅛ in.; over-all length, 34⅞ in.; bore, 4⅛ in.; stroke, 6 in.; displacement, 982 cu.in.; fuel consumption (maximum), 11½ gal. per hour; fuel consumption (cruising), 8½ gal. per hour.

The Wilford gyroplane

CONSIDERABLE experimental work has been carried on at the Main Line Airport, Paoli, Pa., during the past year, on a new type rotating wing aircraft invented in 1926 in Germany by Walter Rieseler and Walter Kreiser, and now being developed in the United States by E. Burke Wilford of the Pennsylvania Aircraft Syndicate.

The machine differs from the Cierva type autogiro in the method employed to equalize the lift on opposite sides of

The Wilford experimental gyroplane. Unlike the autogiro, the rotor blades are fixed at the hub, and are free only to twist or feather. The plane is powered with a 90-hp. Cirrus.

the rotating airfoil system. In the latter machines, equalization is obtained by articulating the blades of the rotor at the hub so that they are free to flap both vertically and in the horizontal plane, and the blades are restrained from twisting about their longitudinal axes. In the Wilford gyroplane, however, the blades are restrained at the hub both in the horizontal and vertical planes, and are free only to twist, or feather. The opposite blades of the four-bladed rotor are connected rigidly together so that as the angle of attack on one side increases, that on the opposite side decreases. A certain degree of lateral control is obtained by adjusting the angles within which the blades are free to feather. An ingenious system of adjustable stops, interconnected with the ailerons on the stub wing, and operated from the control stick in the cockpit permits the lift to be adjusted laterally so that the machine may be banked as desired in flight.

Considerable attention has been given to the plan form of the blades themselves. The original set was curved in outline, resembling somewhat a sweptback propeller blade form, but the present experimental rotor consists of four blades of rectangular plan form assembled without dihedral, or sweep back. It is anticipated that the flat top rotor, that is, one which rotates without coning, will have a lower drag coefficient than one in which coning is permitted. It is claimed also that the use of rigid spars permits the use of a high lift airfoil section and reduces the over-all weight of the rotating wing system. It also permits more ground clearance for the rotor blades, making possible the use of greater fin area in the tail, and reducing the liability of blade damage from striking objects on or near the ground. The rigid blades may also be rotated at higher speeds than the flexible blade system, thereby permitting a reduction in span of the machine.

The general characteristics of the experimental Wilford gyroplane are: Rotor diameter, 25 ft.; length overall (of fuselage), 21 ft. 5 in.; height overall, 9 ft.; disk area, 490 sq.ft.; blade area, 24 sq.ft.; fixed wing area, 100 sq.ft.; gross weight, 1,500 lb.; disk loading, 3.5 lb. per sq.ft. of swept area; power loading, 16.5 lb. per hp.; engine, 90-hp. Cirrus.

Approved type certificates

DURING the period Oct. 24 to March 11, the Aeronautics Branch of the Department of Commerce issued the following Group I approved type certificates: 454, Sikorsky S40 (four P.&W. Hornet B's 575 hp.); 455, Taylor Cub E2 (Continental A40 37 hp.); 456, Heath LNB4 (Heath B4 25 hp.); 457, Stinson Junior R (Lycoming R680 215 hp.); 458, Stearman 6H (Kinner C5 210 hp.); 459, Stearman 6L (Lycoming R680 215 hp.); 460, Waco KCA (Kinner K5 100 hp.); 461, Stearman Alpha A (P. & W. Wasp 450 hp.); 463, Curtiss-Wright Travel Air 16E (Wright R540 165 hp.). Approved type certificates were issued for the following engines: 76, Pratt & Whitney Wasp SD, 500 hp. at 2,200 r.p.m. at 7,000 ft.; 78, Wright R975E2, 420 hp. at 2,150 r.p.m.; 79, Guiberson Aero-Diesel A980, 185 hp. at 1,925 r.p.m.

WHAT OUR READERS SAY

Airport facilities and the business plane operator

TO THE EDITOR:

We purchased a Stinson Junior monoplane in May, 1930, and flew it away from the factory at Wayne, Mich. Since that time it has operated more than 800 hours, taking us over most of the United States, Canada, and Mexico and into practically every oil field of consequence on the North American continent. As an aid in contacting purchasers and users of our instruments the plane has been invaluable. It has certainly helped to increase our business while materially conserving both our travel time and money.

Both of us are enthusiastic over flying and its possibilities in business but cannot help criticising the exorbitant prices charged by racketeering taxi and rent car drivers against people flying in planes. They, no doubt, feel that these people are well-to-do and can stand the racket.

There is also a lack of service in airports. When a party drives into a service station with a car, there are usually from one to three men jumping sideways to sell gasoline, wipe the windshield, etc. In the majority of airports when a landing is made there seems to be some question in the minds of the attendants as to whether they should get off their seats and come out to the plane to see if there is a possibility of selling some gasoline. Examples to the contrary are Ponca City, Okla., and East St. Louis, Ill.

Also, although we are usually taxed from $2.50 to $3.50 per day for storage there is a lack of proper supervision of the equipment while stored. On several occasions we have experienced minor damages to the plane and the loss of accessories, such as first aid equipment, tools, etc., through petty theft. Upon one occasion part of our map equipment was lifted. Of course such things as this are not noticed until one is well on the way, and this caused us to get entirely off the contemplated route and barely make our destination by the skin of our teeth.

Organizations such as the Aviation Division of the California State Chamber of Commerce, working in connection with experienced people engaged in all sorts of business connected with aviation, are doing a splendid work to rectify these difficulties and have already been responsible for changing a number of almost intolerable conditions around some of the airports.

We might sum the foregoing up by saying that it is sincerely hoped by our concern that conditions will permit the continued use of this—or a new plane—in our business.

W. R. MARTIN *and* E. L. DECKER,
Martin-Decker Corporation,
Long Beach, Cal.

AIRPORT MANAGEMENT

Special events interest private plane owners

STIMULATION of interest in every phase of flying activity at his field is, of course, one of the main considerations of the airport manager, particularly the manager of a medium sized or small field. The Pylon Club of Patco Field, Norristown, Pa., has conducted a number of events which have provided considerable sport for the owners of private aircraft. Treasure hunts, fox and hounds chase, bomb dropping and landing to a mark have been held on successive Sundays.

In the treasure hunt pilots were instructed to fly at a minimum altitude of 1,000 ft. and at a cruising speed announced by the pilot in advance and on which his handicap was based. He was on his honor not to exceed that speed during the contest. As each pilot was given the signal to start he was handed his first clew, a hint as to which airport he was to seek; where he received his next clew. Copies of clews had to be brought back to the pilot and descriptions of two markers to be observed from the air. The course as laid out by the manager of the hunt covered 76 miles; thirteen pilots participated.

The first clue advised the pilot that in a certain area was a field bounded by a railroad, the Schuylkill River and a creek, and that on that field was a marker resembling one of seven markers drawn on his card and a cryptogram, the key to which appeared on the card also. It turned out that the deciphered cryptogram spelled Skyhaven. The pilot therefore went there and landed, receiving another clue to the effect that he was to set his course 3 deg. 40 min. south of east, fly approximately seven miles, then change his course to 8 deg. east of north and land at an airport approximately seven miles away. On this route was a marker, a sketch of which had to be submitted to the judge.

At this airport the clue was included in a poem, careful reading of which indicated that the name of the next airport had two words and that the first "name's unwelcome the first of the month." There were two possibilities—Flying Dutchman and William Penn. The reference to a "bill" indicated William Penn. On arrival at this field he was asked the pass-word, which was a word enclosed in quotes in the abovementioned poem. Then he was given a poem the first letters in each line of which spelled Pitcairn. At that field he was given a poem which directed him to his starting point at Patco Field.

The winner got away at 2:50 and returned at 3:52. Some contestants strayed to Trenton, Camden and Wilmington, Del., The hunt was organized and directed by H. H. Lament. Such events should contribute a great deal of activity to the airport program.

Effective emergency truck for airport use

BOLLING FIELD is using an efficient emergency truck built by Harmon-Harrington from designs by the Army Quartermaster Corps. The machine is extremely light for its size and extra large balloon tires are fitted, making it possible to drive the car at high speed with safety. It includes a pump and Foamite generator, the Foamite supply being contained in the extra buckets just behind the driver's seat. Acetylene cutting equipment is included.

Airport improved under relief plan

AIRPORTS have an opportunity these days to secure labor for field improvements at little or no cost under the provisions of community and state employment relief programs. An example of what can be done is the experience of the Norwich Airport at Norwich, N. Y. This field had been built and owned by a public-spirited citizen and opened to the public. In order to have work done on it under the auspices of the State Unemployment Relief Commission, the attorney general ruled it would have to be bought or leased by the city. A lease was therefore drawn up guaranteeing free use of the landing area to all travelers by air.

The city of Norwich agreed to furnish 2,500 hours of labor to be paid for principally by the state commission. The labor was applied to improvement of the runways and the general surface. This project is particularly opportune, and might be duplicated at many airports under the relief programs of New York and other states.

Hangars for shows and conventions

SELECTION of the huge hangar at the Detroit City Airport for the meeting and show of the American Road Builders' Association in January indicates a potential source of income or promotion for many ports in large centers with hangar space available for exhibitions and conventions. Hangars are easily adapted to the requirements for large, unobstructed floor areas which must bear heavy weights, as in the Detroit case where all types and sizes of roadbuilding machinery will be assembled. There is the additional advantage in having displays all on one floor level, both as to convenience and reduced cost in placing exhibits. Clearing a hangar of tenant aircraft temporarily may be done in a very short time and handling is facilitated by the wide doors which feature every hangar.

The Air Corps' efficient emergency truck at Bolling Field

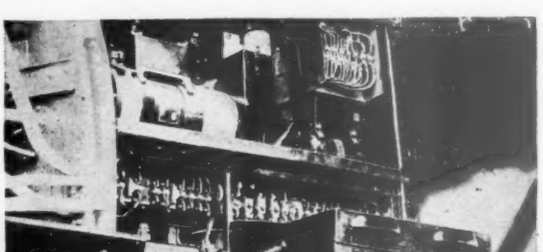
DESIGN NOVELTIES

Electrifying the airplane

NOT many years have elapsed since the only electrical problem on an airplane beyond the engine ignition system involved only the running of a pair of wires from the magnetos to a switch on the instrument board. Nowadays, however, with complicated starting and lighting systems, and the radio, the problem has become vastly more involved. Unless it is treated as a major item during the design period, a conglomeration of apparatus and miscellaneous wiring may easily result that will prove not only inconvenient and expensive, but positively dangerous.

In the Pilgrim 100-A Transport (AVIATION, November, 1931, page 654) built by the American Airplane & Engine Company of Farmingdale, N. Y., a careful study was made of the disposition and interconnection of all electrical equipment. The heart of the system is the power supply and distribution compartment, aft of the fire wall in the left side of the fuselage below the pilot's cockpit. Access is gained from outside the airplane by removing a section of the side paneling. The compartment contains two dynamotors for radio use, a 65-amp. battery, and a terminal panel, together with incidental electrical equipment. All wiring has been brought out to the terminal panel which makes it a simple matter to test out circuits. Outside the compartment all wiring is carried in aluminum conduits through junction boxes. A novel mechanical feature is the mounting of the battery box on an extending slide (built on the principle of a commercial filing cabinet) so that it can be pulled out of the compartment for servicing.

The radio transmitter and receivers are located in the rear part of the fuselage adjacent to the radio mast. The tunning and volume controls, as well as all light switches are conveniently located on the pilot's instrument board. Fuses and switches are mounted on a panel which may be easily swung outward from the face of the board for inspection or adjustment. Although the electrical circuits are vastly more complicated than those of 1921, careful planning during the design stages has resulted in actual simplification from a maintenance point of view.



Above: Electrical power supply equipment of the Pilgrim 100-A. Note the compact arrangement of dynamotors and relays, the accessibility of the terminal boards, and the ingenious battery mount. The latter is shown in position for battery servicing. Right: A muffler on an Eastern Air Transport Condor.

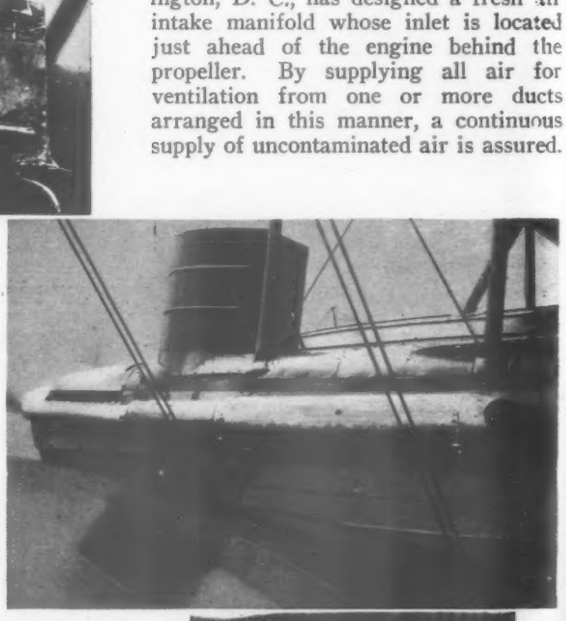
Mufflers for Condors

AFTER some months of experiment, the Curtiss Condors flown by Eastern Air Transport are being equipped with newly-designed mufflers developed under the direction of Ralph G. Lockwood, chief engineer. Service tests have indicated that the mufflers have little, if any, effect on the operation of the engine, and that they are very effective in reducing noise.

Instead of manifolding and exhausting each bank of the Conqueror engines individually, the exhaust pipe from each set of inboard exhaust ports is carried forward and across the nose cowling of the nacelle. The same pipe continues aft, picking up the exhaust from the outboard ports, and terminating in a section of large diameter pipe about 6 ft. long. Inside the tail pipe a spiral sheet metal baffle gives a spinning motion to the gases. The area of the passages is so great that little back pressure develops. A heating section just ahead of the muffler warms the air for the cabin.

Improving cabin ventilation

IT HAS been well established that even minute quantities of exhaust gases in airplane cabins tend to induce air sickness. Believing that a certain amount of contamination of this sort cannot be avoided when ventilating air is admitted to cabins directly from the slipstream aft of the engine as is common practice, C. F. Jenkins, of Washington, D. C., has designed a fresh air intake manifold whose inlet is located just ahead of the engine behind the propeller. By supplying all air for ventilation from one or more ducts arranged in this manner, a continuous supply of uncontaminated air is assured.



Aviation

The air intake behind the propeller insures fresh air for the cabin.

SERVICING SHORT CUTS

Blackboard engine log chart

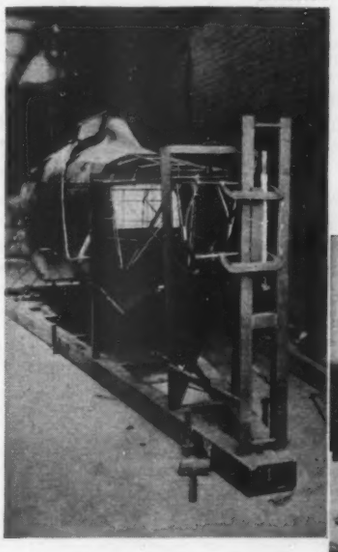
A GOOD example of the blackboard-type engine log chart now used by a number of airlines to keep track of engine service and overhauls is in use at the Oakland headquarters of the Pacific Air Transport division of United Air Lines.

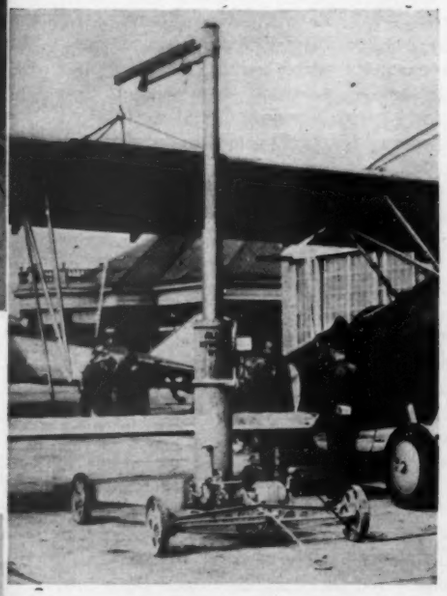
Aluminum tags which are punched with the name of each airplane in service are hung on pegs, in a vertical column at the left of the board, large tags being used for tri-engined planes and small tags for the single-engined equipment. Opposite each plane there are one or three tags respectively corresponding to the number of engines. Aluminum tags are used to designate Pratt & Whitney Wasp engines, and brass tags are used to designate Hornets. Horizontal columns extend across the board opposite each engine with vertical lines to represent each five hours of operation. A heavy white line is used to mark the 100- and 200-hour periods and a heavy vertical red line marks 300 hours, at which all engines are overhauled. Each day the shop foreman checks the log of each engine and brings the blackboard record up to date.

By constantly checking the engine time record on the board it is possible to schedule the operation of the various airplanes and engines so that the engines will come up for their 300-hour overhaul in proper sequence, and the shop is never overloaded due to a number of engines reaching the overhaul period at the same time. This chart also eliminates the possibility of running any engine beyond 300 hours without overhauling.

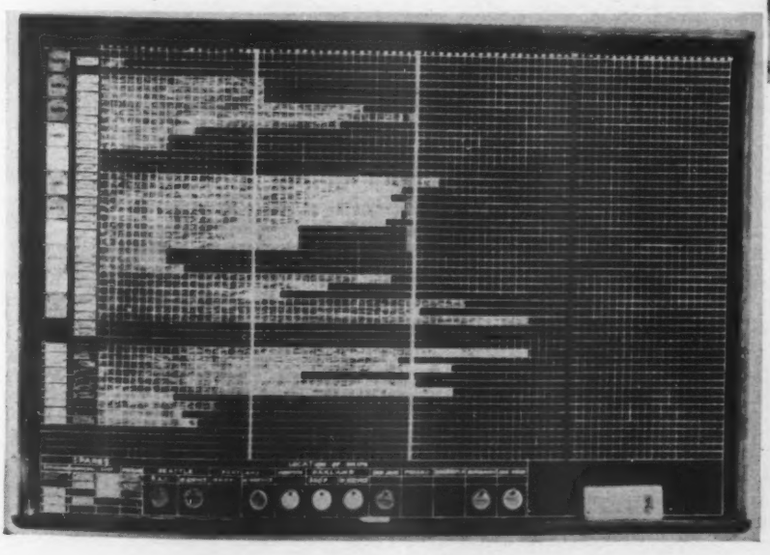
Engine tags representing spare engines are hung in a section at the lower left hand corner of the board in columns showing whether the engine is serviceable or unserviceable, in the shop, or in storage. Additional round cardboard tags hung on pegs along the base of the board are used to designate the location and condition of all planes actually in service.

Aviation





Above: Repair jig at Eastern's Atlanta depot. Below: The blackboard log chart for engines, at Pacific Air Transport. Right: Portable Allith-Prouty hydraulic hoist at United Airlines Chicago base.



Structural steel repair jig

REPAIRING damaged members in the fuselages of Pitcairn Mailwings, at the Atlanta Repair Depot of Eastern Air Transport, Inc., is materially facilitated by the use of a heavy structural steel jig, into which the entire fuselage may be firmly clamped. Once the fuselage is leveled up and fastened into position, repair work may be carried out without danger of serious misalignment of the structure.

A portable hydraulic hoist

FOR rigging airplanes and for removal and replacement of engines, the Chicago base of United Airlines is finding considerable use for a portable hydraulic hoist manufactured by the Allith-Prouty Company of Danville, Ill. It is a self-contained unit incorporating hydraulic cylinders, valves, and electrically driven pumps. Its mounting on a wide spread chassis affords portability without the sacrifice of stability. The machine is capable of handling the largest engines now in use.

THE AIRCRAFT YEARBOOK FOR 1932, *compiled by The Aeronautical Chamber of Commerce, D. Van Nostrand, New York; 626 pages.*

THE yearbook of the Aeronautical Chamber of Commerce took its permanent place as a reference volume some twelve years ago. It appears this year very much in the familiar form, but much better arranged and better printed than ever before. Illustrations are more numerous than in the past, and better selected.

The events discussed range from the round-the-world flight of the Winnie Mae and the launching of the Akron to the first amateur seaplane cruise. Aviation is covered abroad as well as at home, and in the laboratory and classroom as well as in the air. There is the usual collection of drawings of new planes of the year, better classified than ever before. There is the usual 200 pages of reference material, statistical and otherwise, including a general directory of American aviation. That, too, is in a form offering an improvement over any previous year. Most of the basic statistics are already familiar to the readers of the statistical issue of AVIATION, but some of them are quite new. Novel forms of graphical presentation have in several instances been employed, and prove very effective. The one very serious weakness there is in a series of outline maps in which the volume of activity is plotted by states without any recognition of the fact that the 48 states are not identical in area and in population.

Taken as a whole, it is an indispensable volume. The aeronautical industry could hope for nothing better than that the book may find a place in every public library in the country and on the desk of every managing editor of a newspaper.

THE AIRPLANE AND ITS ENGINE, *by C. H. Chatfield and C. F. Taylor; McGraw-Hill Book Company, New York; 1932; 443 pages; $3.*

THE book prepared by Professors Chatfield and Taylor, once associated at the Massachusetts Institute of Technology, has already made its reputation in its first edition. The second edition, very largely rewritten, maintains the quality of the first, and is brought thoroughly up to date. Two hundred and seventy illustrations are taken almost entirely from very recent practice.

The volume is designed principally for use in high schools, vocational schools, and general courses in colleges. It will make excellent reading for business men having a general interest in, or some non-technical connection with, the aircraft industry and wanting to know more of the mechanical fundamentals of the craft with which they have to deal. It would, in fact, be a good thing if "the Airplane and its Engine" could be made compulsory reading for every member of the board of directors of an airplane or aircraft engine company who has obtained his position, for financial or other reasons, without ever having served apprenticeship in an airplane factor or on a flying field.

HANDBOOK OF THE BRITISH GLIDER ASSOCIATION; *44 A Dover St., London, W.1; 109 pages.*

THIS official publication of the British Glider Association includes statements of the organization of the association and affiliated clubs, the by-laws, list of holders of gliding or soaring certificates, competition rules, and a short historical sketch of the association's activities are included. Sections are devoted also to glider insurance and to methods of interpreting weather information.

BARNARD ON LEARNING TO FLY, *by C. D. Barnard; Macmillan Company, New York; 1931; 172 pages; $5.50.*

CAPTAIN BARNARD is one of those pilots whose deeds have peculiar appeal to the public. After many years of miscellaneous flying activity, including a long experience as an instructor, he claimed the attention of the British populace by flying from London to India and return in seven and a half days. The interest in his performance was increased, though his popularity may not have been, by his use of a Dutch airplane and by subsequent explanations that no British machine has been fit to do the job.

His book is not written for those who are on the point of breaking transcontinental records. It is a simple and workmanlike explanation of the elementary problems of flight, and it is aimed at the complete novice. The process of learning to fly is outlined, the various maneuvers are described in detail. Landing, for example, receives 30 pages of text, with special notes on such specialized points as the making of landings into the glare of the setting sun.

While it would be easy to imagine a better book, for Captain Barnard's work is simply competent and not inspired, no better one for this particular purpose now exists. The student pilot who wants to supplement air work with library work may take his choice between this volume and Lieutenant Studley's well-known work for his introduction to the subject.

APPLIED WING THEORY, *by Prof. Elliott G. Reid; McGraw-Hill Book Company, New York; 1932; 231 pages; $3.*

NOT for a dozen years has there been a serious attempt at a simple general review of mathematical aerodynamics in the United States. Stalker's Principles of Flight covered the field in a general way, but mingled so many topics that the development of the fundamental wing theory had to be somewhat neglected. American readers not conversant with German have usually had to depend on Glauert's well-known volume. Now Professor Reid, formerly of the staff of the National Advisory Committee and more lately of Stanford University, has filled the gap.

It is not easy to write such a book for American readers, for most American engineers are shockingly lacking in fundamental mathematical training. Wing theory cannot be made non-mathematical, but Professor Reid has made it as simple as possible. Avoiding great numbers of references and citations from the work of the German physicists who are responsible for most of the development of the subject, he has written a straight-forward text which can be read as a whole without interruption. It should not be beyond the capacity of any engineer who has graduated from an American technical school of good quality or who has had two years of calculus and the elements of differential equations.

The arrangement, as already suggested, is excellent, and discussion of the theory of several practical problems, such as ground effect, is included. The author has achieved a nice compromise between the purely mathematical and the purely physical points of view, and has interpreted the results of mathematical analysis, wherever possible, in terms of description of the physical phenomena involved or of mechanical analogy.

AIRCRAFT AT WORK

Aid to sales and service

A STINSON Junior, purchased in May, 1930, by the Martin-Decker Corporation, Long Beach, Cal., has been used constantly by W. R. Martin and E. R. Decker in connection with distribution and service of their general line of oil field instruments. The plane has been flown more than 800 hours, and has been used by executives of the company in reaching most oil fields of importance in the United States, Canada, and Mexico. There have been no engine failures and but two forced landings, one caused by weather and the other by running out of fuel.

Left to right: W. R. Martin, president of the Martin-Decker Corporation, E. L. Decker, secretary and treasurer, and Harvey Martin, pilot.

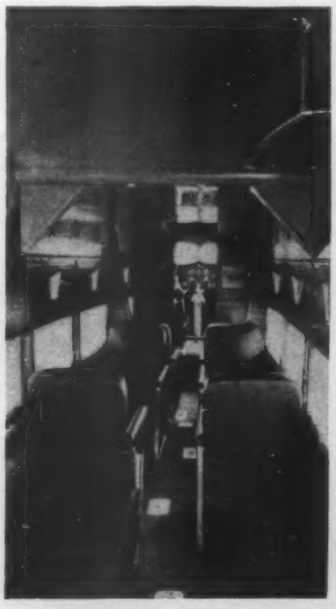
When the plane is used for extensive trips away from the Long Beach base a pilot is employed full time for $300 per month and expenses. He supervises mechanical work which is done at the various airports by certified mechanics. When the plane is based at Long Beach for long periods an arrangement is in force with a local pilot who is a fixed base operator. He stores the plane, takes care of the mechanical work and flying on an hourly basis, and is available for trips of several days' duration on a scale of $10 per day and expenses. The Lycoming engine was not overhauled until after 500 hours of operation and has given full satisfaction at all times.

A careful record of the plane's performance shows that the average consumption of fuel is 11 gal. per hour, and of oil, 1 qt. per hour. The cruising speed has approximated 91 m.p.h., ground speed.

It has been found that the plane cuts time on the road to about one-third of that of surface transportation.

Demonstrating club plane possibilities

ONE of the first models rigged in England by the Ford Motor Company branch was made especially attractive as a demonstration plane by fitting out the fuselage with club appointments. Particular attention was paid to the interior decorating, which was done in brown, green and tan combinations with hunting scenes suggestive of the English sporting tradition.



Interior of the Ford club plane

Mining engineer finds plane effective

AN EXCELLENT example of aircraft use in field work is afforded by the experience of C. F. Williams, district mining supervisor in Miami, Okla., for the Conservation Branch of the United States Geological Survey. It also stands as a strong argument for a change in the government's standardized travel regulations.

Mr. Williams used three small cabin monoplanes. fitted with engines ranging from 90 to 110 hp. His most recent machine is a Cavalier 90, a two-place cabin monoplane. Between July 1 and Dec. 31, the plane was flown 18,400 miles at a direct operating cost of $832.49, or 4.52 cents per mile. No insurance was carried. The figures include fuel and oil, storage, parts and repairs. Among the repairs was a normal periodic overhaul costing $200. The cost per mile including depreciation and storage amounted to 6.15 cents and excluding depreciation and storage 3.59 cents. The original investment was $1,750, a used plane being selected. A total of 1,337 gal. of gasoline was consumed and 306 qt. of oil, giving 13.8 miles per gal. and 89.3 miles per qt., respectively.

By recognizing the airplane as a vehicle eligible for travel compensation at least equal to that awarded owners of automobiles, the government would be in a position to substantially encourage use of aircraft in business. Under the present regulations operators of aircraft may secure compensation indirectly under the provisions governing use of common carriers. Reimbursement as it now stands would be at the rate of slightly less than 2 cents per mile, it would include only the cost of fuel, oil and hangar rent. This would mean a loss per mile of about 5 cents. The automobile owner is allowed as much as 7 cents per mile, obviously indicating that aircraft should be given consideration in the travel regulations. Mr. Williams reports that there is a saving of about 30 per cent in time by use of the plane, making aircraft in many sections and of certain types less expensive than automobiles.

Mr. Williams' outlay during the period was: Gasoline $256.89 (1.39 cents per mile), oil $48.05 (0.26 cents per mile); parts and repairs $357.55 (1.94 cents per mile); and storage $170 (0.93 cents per mile).

TACOMA PUBLIC LIBRARY

THE BUYERS' LOG BOOK

Light relay

For controlling electrical or other apparatus from the intensity of light the Weston Electrical Instrument Corporation, Newark, N. J., offers the Photronic Cell, a new type of photo - electric cell of simple construction, which does not involve liquids, vacuum or gas, and is therefore not subject to chemical or physical change. The cell consists essentially of a thin metal disk on which there is a film of light sensitive material which forms a negative terminal while a metal collector ring in contact with the disk forms the positive terminal. The unit is contained in a molded bakelite case, 2¼ in. in diameter and 1 in. thick, having a glass or quartz window and connecting plugs to fit a UX radio socket.

Photronic Cell.

The Photronic Cell delivers about 1.4 microamperes per foot-candle of light intensity or 120 microamperes per lumen. No amplification is required for ordinary use, and sufficient current is developed to operate Weston relays directly without auxiliary apparatus. At present the life of the cell is believed to be unlimited.

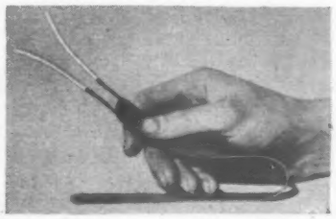
Applications are found in airport beacon control, production recording, time studies, and many other phases of aeronautical activities. The Model 594 Photronic Cell is inexpensive and may be purchased separately or in connection with suitable power relays produced by the same manufacturer.—AVIATION, *April 1932.*

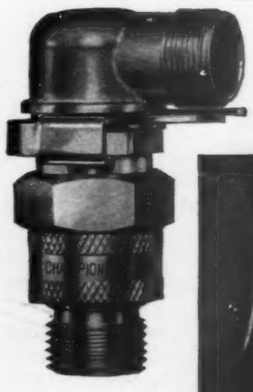
Bolt cutter

H. K. Porter, Inc., of Everett, Mass., has added a new cutter to its line of bolt and rivet cut-off tools. It is small in overall size (7½ in. long) and is designed to operate in limited spaces where the ordinary bolt cutter cannot be used. It will cut bolts up to ⅜ in. in thread diameter, and round stock up to ⅞ in. in diameter. The tool consists of a cutting head with the jaws operated by a power screw turned with an ordinary ½-in. ratchet wrench.—AVIATION, *April 1932.*

Heating units for clothing

Light, flexible electrical heating units, designed for use in flying suits, aviators' gloves, etc., for high altitude flying in cold weather, have recently been announced by the General Electric Company of Schenectady, N. Y. Each unit consists of a thin rubber strip about ½ in. wide and 12 in. long, having a heating element designed to work on a 12-volt airplane storage battery, vulcanized inside. Each unit draws about ⅓ amp. and is rated at about 3½ watts. The Army Air Corps at Wright Field has been experimenting with these units for winter operation. — AVIATION, *April 1932.*





Above: A General Electric heating unit for flying clothes. Left: The Champion shielded spark plug. Below: Porter bolt-cutter.

Shielded spark plugs

The Champion Spark Plug Company of Toledo, Ohio, has just announced a new aviation spark plug incorporating radio shielding. A metallic dome over the terminals not only protects the plug against short circuit by dirt, rain, ice or oil, but it eliminates radio interference and protects it against mechanical damage. This plug, which is designated as the Aero-RA, is adapted for use in practically all types of air-cooled and high compression water-cooled engines. It is made up in two units, either of which can be purchased separately as required.—AVIATION, *April 1932.*

Piston rings

Piston packing rings for all types of internal combustion engines, air compressors, etc., are being offered by The Steel or Bronze Piston Ring Corporation, Indianapolis, Ind. Rings are available in any diameter from 1 in. up to any cross-section desired, in either alloy steel or bronze, depending upon the requirement.—AVIATION, *April 1932.*

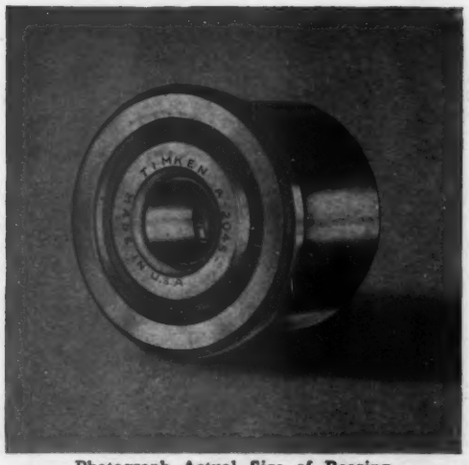
Automatic sprinklers

Sprinkler fire protection systems for shops, hangars, etc., are manufactured by the Viking Automatic Sprinkler Company, 450 East Ohio St., Chicago. The Viking equipment includes not only standard deluge systems, but also a preaction system designed to sound an alarm at temperatures below those required to open sprinkler heads so that small fires may be controlled by hand extinguishers before the deluge system is released. In case the warning is overlooked, however, the sprinkler heads go into operation with further increase in temperature. — AVIATION, *April 1932.*

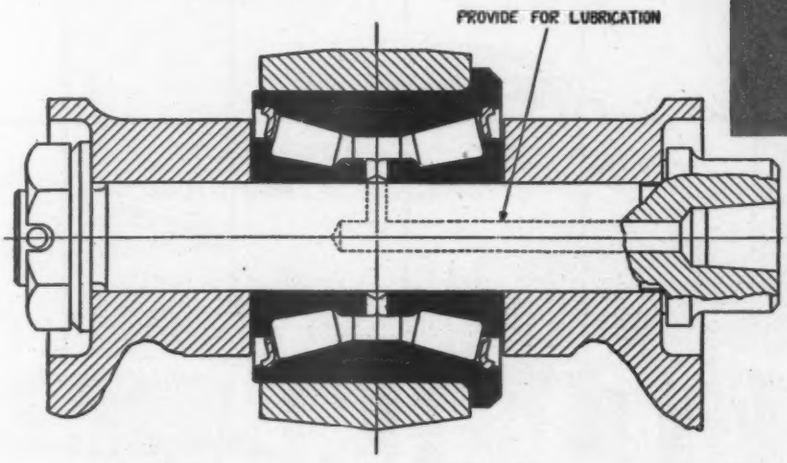
Fire-proofing paint

The Specialty Trading Company, of 9 Via Ruffini, Milan, Italy, is offering for sale a fireproofing paint designed to reduce the fire hazards on airplanes and other structures. It is claimed that the paint, which when applied resembles an ordinary aluminum finish, renders fabric incombustible, even in the presence of burning gasoline.—AVIATION, *April 1932.*

Good-bye to rocker arm bearing troubles



Photograph Actual Size of Bearing.



The Timken Tapered Roller Rocker Arm Bearing was developed to meet the need for a more efficient and enduring rocker arm bearing for modern aircraft engines.

Its design and construction assure extended service; greater dependability; and lower maintenance cost.

"Brinnelling", or grooving, of the bearing races is one of the principal causes of short life in many types of anti-friction rocker arm bearings. The long life of Timken Rocker Arm Bearings is largely due to the line contact of the double row of tapered rollers plus Timken-made special alloy steel. The tapered rollers also give maximum support to the rocker arm shaft, hold it in proper alignment and overcome the tendency of the push rod action to produce lateral wear and looseness. Accurate rocker arm operation is maintained throughout the life of the bearing.

Lubrication is positive under all operating conditions. A high level of lubricant is constantly maintained. Tight closures prevent escape of grease.

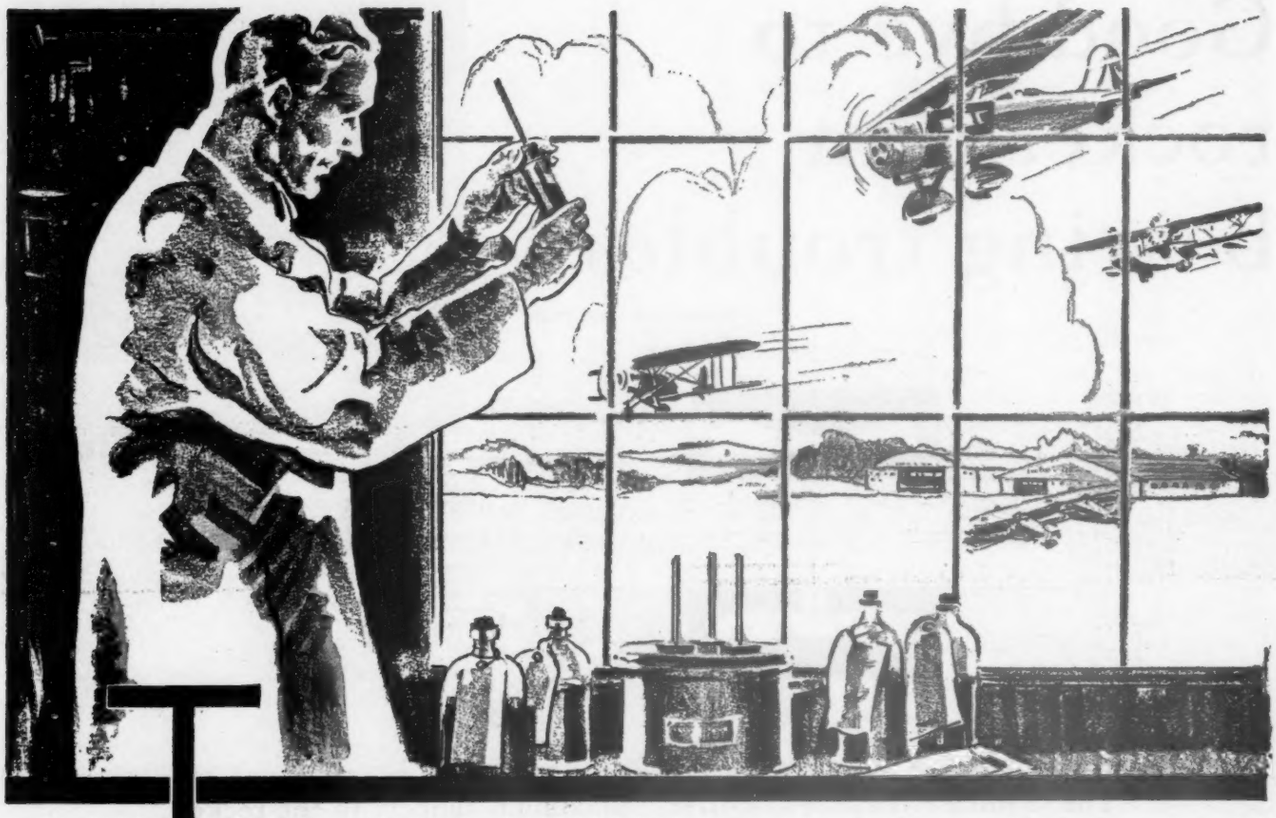
The Timken Tapered Roller Rocker Arm Bearing is a compact unit, completely self-contained. It can be installed, removed and replaced in much less time than other types.

Specify this modern refinement when buying new engines.

National Aircraft Show
Booths No. 101 and 103

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

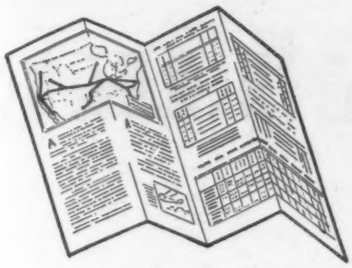
TIMKEN *Tapered Roller* **BEARINGS**



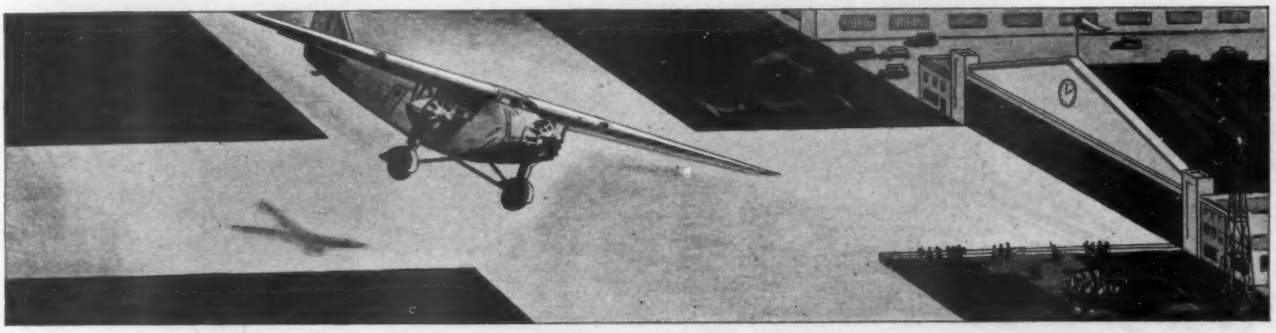
TESTED *in the laboratory*
PROVED *in the air. . . .*

Laboratory tests prove the special qualities for effective lubrication in Texaco Airplane Oils. Laboratory tests at every stage of the refining process insure the maintenance of absolute uniformity. • Tests in the air, by famous pilots, and by The Texas Company's own planes, prove their qualities in actual service under the most severe conditions of altitude, temperature and long maintained speed-flying. • Captain Frank Hawks in his mystery ship, the Texaco 13, made over 68,000 miles of record-breaking flights without a single engine overhaul. • Texaco Airplane Oils are characterized by their exceptionally flat viscosity curve, low pour point and low carbon residue content. They are ideal airplane engine oils. • They are approved by engine manufacturers, recommended and used by many of the outstanding aviators and are available at leading airports throughout the country. THE TEXAS COMPANY, 135 East 42nd Street, New York City.

TEXACO AVIATION GASOLINE • TEXACO AERODIESEL FUEL • TEXACO AIRPLANE OILS • TEXACO MARFAK GREASES • TEXACO ASPHALT PRODUCTS (For runways, hangar floors and aprons and dust laying)



Flying schedules call for swift communication between airports



Teletypewriters send *written* messages to 2 or 20 points at the same time...whether they are 300 feet or 3000 miles away

IT IS 10 O'CLOCK. The dispatcher signals, "All Clear." There is a whirr of motors, and the huge air liner soars into the sky. In front of the pilot is a typewritten sheet giving last-minute weather reports *gathered from points along the entire route by Teletypewriter....*

The 2 o'clock plane is ready to leave. There is an unexpected call for seats at a city 90 miles ahead. *Arrangements are made by Teletypewriter* to release space originally reserved for another city, where the day's demand proves lighter....

An important express shipment is carried on the 4 o'clock plane. It is essential that it be delivered to the consignee immediately upon arrival. *A Teletypewriter message explains all details....*

Teletypewriters provide the swift, *written* communication between airports that is so necessary in the successful operation of air lines. A message typed on one machine is identically reproduced at the same moment by all connected machines. The typewritten records guard against mistakes.

This continuous, two-way contact helps to maintain the accuracy of schedules. It is an ideal medium for sending executive instructions; passenger lists; traffic details; accounting matters; freight information.

Teletypewriter Service is now used by the following manufacturing and operating companies: Department of Commerce (Airways Division), Transcontinental-Western Air, Thompson Products, Century Airlines, Ludington Line, Eastern Air Transport.

Your local Bell telephone company will gladly give you complete information about Teletypewriters.

THE NEW TELETYPEWRITER SERVICE

The recently announced Teletypewriter Service permits any subscriber to it to typewrite by wire instantly to any other subscriber, whether he be around the corner or across the continent. This service differs from private line Teletypewriter Service, described on this page, in that any subscriber may ask for any other subscriber and be connected immediately by the teletypewriter "central."

TELETYPEWRITER SERVICE

YOU BET THEY LIKE

Every headline reader knows AL. WILLIAMS *and his acrobatic flying. His Curtiss Hawk has Airwheels*

Nobody knows more about speed than JIMMIE DOOLITTLE. *Here's his Lockheed-Vega on Airwheels*

A National Air Tour isn't complete without GEORGE HALDEMAN. *Note Airwheels on his Bellanca Airbus*

Anyone who knows aviation knows the names shown here. They represent the veterans of speed, of distance, and of long distance flights over land and water.

And mark this fact, every one of these men uses Goodyear Airwheels.

The fact is, no other landing equipment offers such safety under all ground conditions — nothing else approaches Airwheel safety for emergency landings on plowed ground, swamp land, sand or snow.

When You Buy a New Ship Specify Goodyear Airwheels

GOOD

AIRWHEELS!

BILL BROCK, *of Detroit-to-Tokio fame beside his Fleetster. You can't miss that Airwheel*

He's known aviation ever since it was a baby. E. W. (POP) CLEVELAND *and his Travelair—on Airwheels*

Few pilots have landed on as many fields as V. R. JOHNS. *The plane: Ford; the tires: Airwheels*

Reports from passenger transport operations show that these big, soft, rolling rubber cushions make a real reduction in maintenance costs — and tests will show that nothing else gives surer, smoother control over braking.

If you think these are strong claims, just ask Goodyear to prove them. For complete engineering data, specifications and recommendations for equipping your ships, write or wire to Aeronautics Department, Goodyear, Akron, Ohio, or Los Angeles, California.

Everything in Rubber for the Airplane

Look to electric instruments for performance at low cost

This plane is completely equipped with General Electric instruments, control pulleys, wing-edge landing lights, and a G-E supercharger

CONSIDER, for example, General Electric instruments for indicating oil pressure and temperature. They are connected to the engine fittings by electric wires, and they require no tubing or other mechanical connections. This advantage is also characteristic of the G-E engine-temperature indicator and the G-E tachometer. In fact, it is one important reason why electric instruments cost less to maintain.

The panel illustrated is the most completely electrified aircraft instrument panel ever assembled by any manufacturer. All of the engine instruments, the magneto compass, the turn indicator, and even the sonic altimeter are electrically operated. We invite your interest in this thoroughly modern equipment. Address General Electric Company, Aeronautics Section, Schenectady, N. Y.

Key to numbered General Electric instruments shown above

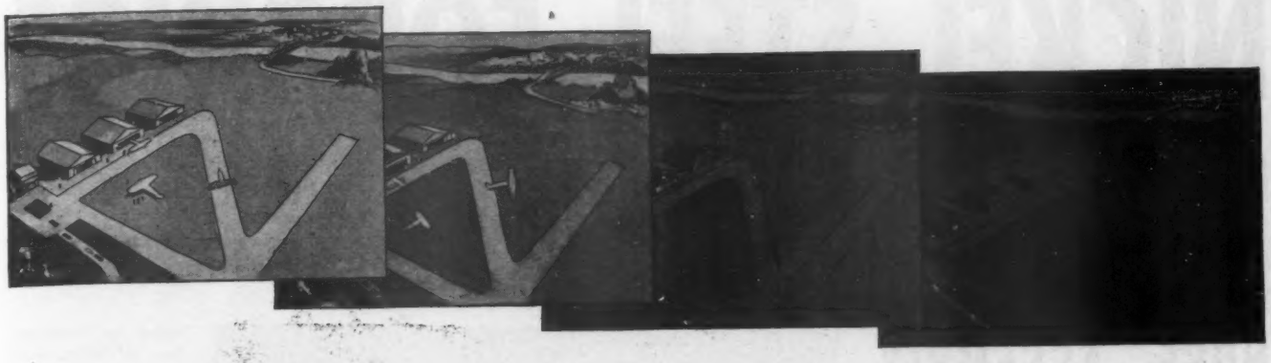
1. Oil-pressure indicator
2. Oil-temperature indicator
3 & 4 Engine-temperature indicator (thermocouple type) and selector switch for 9 cylinders
5. Electric tachometer
6. Electric control switches and fuses
7. Voltammeter
8. Magneto-compass indicator
9. Electric turn indicator
10. Sonic-altimeter indicator
11. Magnetic card compass
12. Compass-sensitivity controller
13. Turn-sensitivity controller
14. Magneto-compass controller

GENERAL ELECTRIC

AËRONAUTIC EQUIPMENT

700-15

SPECIALISTS IN NEW YORK, WASHINGTON, DAYTON, AND LOS ANGELES



Department of Commerce type, 24-inch rotating beacon

IS YOUR AIRPORT ONE OF THE THOUSAND THAT DISAPPEAR AT NIGHT?

Every night, a thousand American airports are lost in the dark; they have no airport-lighting equipment of any kind. Yet, in many cases, the installation of a General Electric beacon would practically double the accessibility — the usefulness — of an unlighted airport. A beacon is the first essential in order to put an airport on the night map of America.

General Electric offers you a complete airport-lighting service that begins with the planning of installation and continues through years of satisfactory operation. Whether your requirement is a beacon or a complete airport-lighting system, we shall be glad to serve you. Ask for descriptive literature. Address General Electric Company, Schenectady, N. Y., or the nearest house of General Electric Supply Corporation.

Electric code beacon used to supplement rotating beacons

General Electric glass-dome type, 20-inch, rotating beacon

GENERAL ELECTRIC

AËRONAUTIC EQUIPMENT

712-11

DISTRIBUTED BY GENERAL ELECTRIC SUPPLY CORPORATION

NICKEL STEEL FORGINGS STAND THE GAFF

NOSE ASSEMBLY OF U. S. S. AKRON WITHSTANDS ABNORMAL STRESSES IN SERVICE.....

SINCE the world's largest airship was put into operation by the Navy, it has been subjected on several occasions to abnormally severe service conditions, involving stresses of unforeseen intensity. These conditions constituted a grueling test for the Nickel Alloy Steel mooring cone and accessory parts, yet they stood up perfectly.

The material used (a Nickel-chrome-molybdenum steel of 2½ to 3% Nickel content) was chosen by the Navy Department and by Goodyear-Zeppelin Corporation, the builders of the "Akron", after careful study of the available materials. The forgings were supplied by The Midvale Company, and the test bars showed the following average results:

Tensile Strength	182,250 p. s. i.
Yield Point	170,500 p. s. i.
Elongation in 2"	14%
Reduction of Area	46.7%

Further evidence of the use of the most carefully chosen materials in the Akron is found in the fact that the eight Maybach engines—similar to those used on the Graf Zeppelin, Los Angeles and other large airships—have Nickel Alloy Steel crankshafts and connecting rods. The outrigger gears driving the propeller are also made of the same tough, dependable material.

Our technical files contain a wealth of data compiled from the experience of users of Nickel Steels in the aviation industry. You are invited to communicate with our staff of engineers regarding special types of Nickel Steels suitable for your requirements.

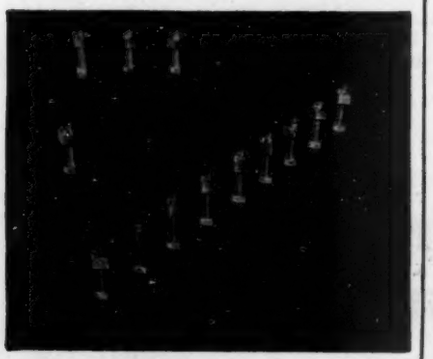
ABOVE: *U. S. S. Akron, world's largest airship, flying over Capitol Building in Washington, D. C. Built by GOODYEAR ZEPPELIN CORPORATION, Akron, Ohio.*

Send for Bulletin No. 9, "Physical Properties of Nickel and Nickel-Chromium Steels".

BELOW: *Nickel-chrome molybdenum steel mooring cone forged by THE MIDVALE COMPANY*

Nickel Steel Parts in Akron

Mooring cone
Spindle
Mooring cone bolts
Outrigger gears
Maybach engine crankshafts and connecting rods



ABOVE: *Nickel Alloy Steel bolts for bow bearing supports used in U. S. S. Akron. Manufactured by THE MIDVALE COMPANY. Nicetown, Philadelphia, Pa.*

THE INTERNATIONAL NICKEL COMPANY, INC.

Miners, refiners and rollers of Nickel... Sole producers of Monel Metal

67 WALL STREET, NEW YORK, N. Y.

Exacting Tests insure the Safety of Roebling Control Cord

In rigging controls with Roebling Control Cord you provide predetermined quality, known stamina and safety of the highest degree. Roebling exercises almost unbelievable care to insure dependability of this important item of plane equipment.

Even before the cord is formed, exacting tests are begun. Each wire is gauged several times, and subjected to a series of twisting and kinking tests. Then the completed cord is put through severe bending, proof-loading and tensile strength tests.

Every Roebling Wire Aircraft Product is made with similar painstaking care. You can have complete confidence in any product which bears the name ROEBLING.

Years of Experience produce these high quality Roebling Aircraft Products

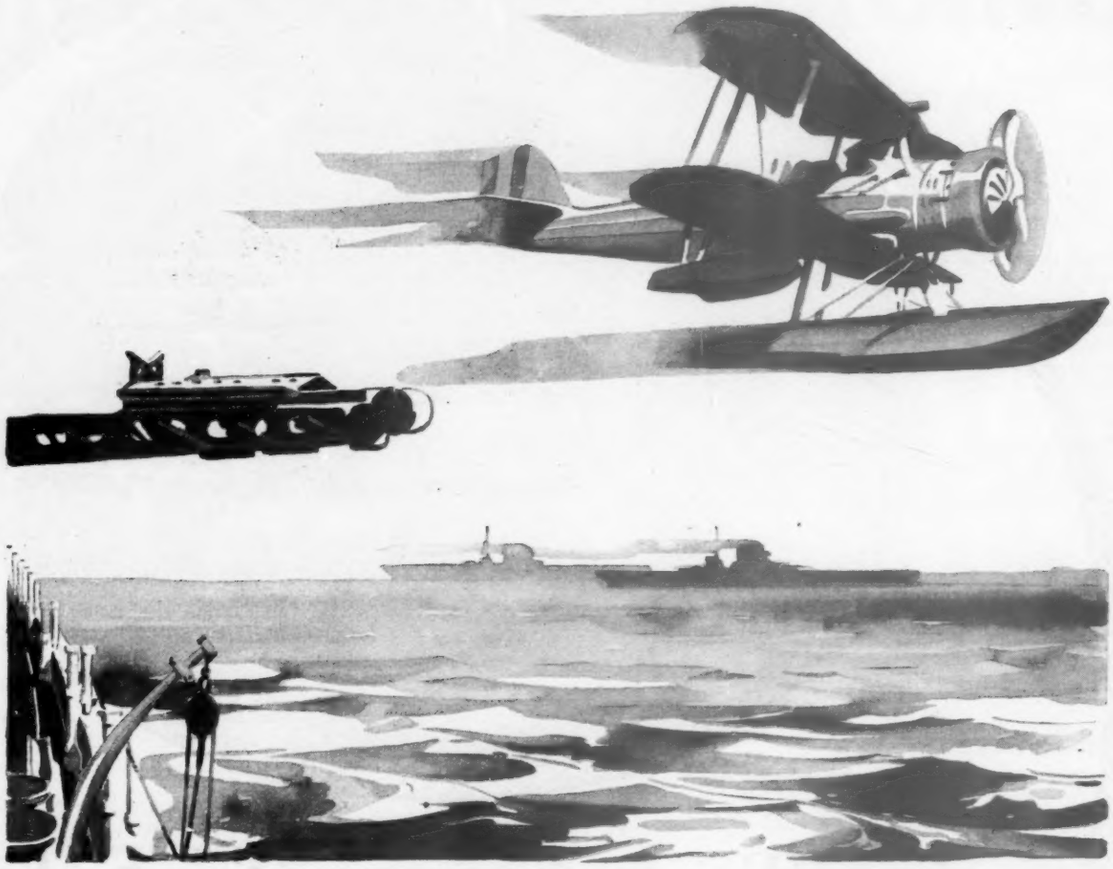
Tinned Aircraft Wire, Galvanized Aircraft Strand, Cotton Center and Wire Center Galvanized Aircraft Cord, Tinned Aircraft Cord, Aircraft Ferrules and Thimbles, Serving and Locking Wire, Control Strand and Casing, Electrical Power and Lighting Cable, High Tension Ignition Cable, Gas and Electric Welding Wire.

JOHN A. ROEBLING'S SONS COMPANY, TRENTON, N. J.

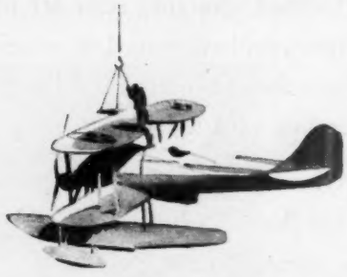
Wire · Wire Rope · Copper & Insulated Wires & Cables · Welding Wire · Flat Wire · Wire Cloth & Wire Netting

Branches in Principal Cities — Export Dept.—New York, N. Y.

ROEBLING WIRE AIRCRAFT PRODUCTS



Out via Catapult ..In via Sling..and ready to go again..

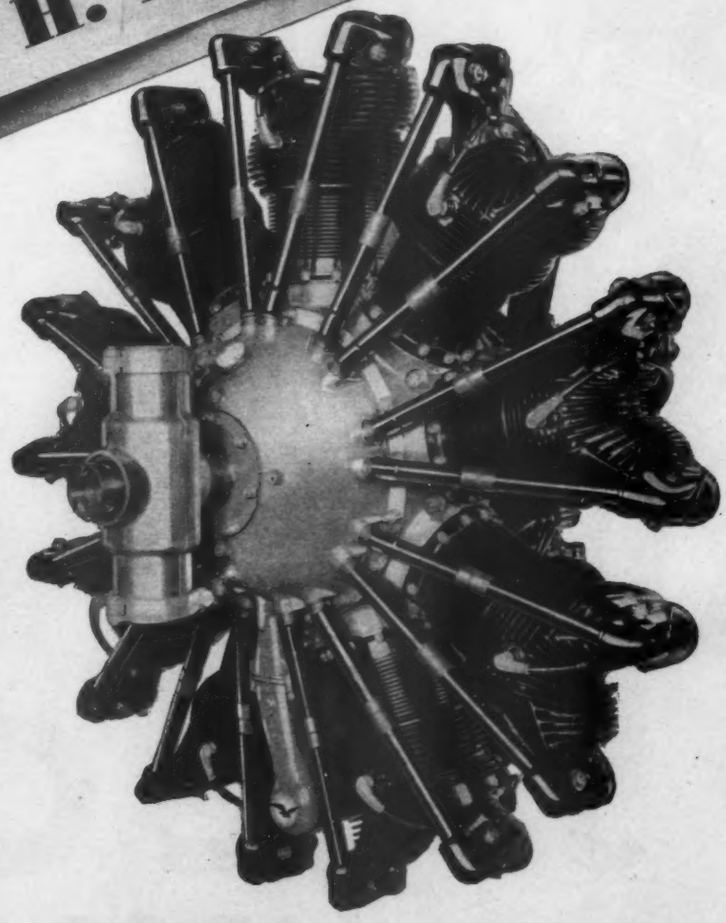


To win the approval of the U. S. Navy for observation work with the Battle and Scouting Fleets, an airplane must have speed, climb and maneuverability well beyond the severest requirements of commercial flying. Dependability and stamina are as basically necessary as engine and empennage. Flights that start on the catapult and end in the hoist sling are convincing tests of quality in design and structure. Because each of the series of new "Corsair" designs has passed all of these tests by generous margins, the Vought "Corsair" has long been the observation plane used on the Navy battleships and scout cruisers. Chance Vought Corporation, East Hartford, Connecticut. Division of United Aircraft & Transport Corporation. Sole Export Representative: United Aircraft Exports, Inc., 230 Park Avenue, New York, U. S. A.

CHANCE VOUGHT VOUGHT CORSAIR **CORPORATION**

READY NOW

NEW MODELS
PRATT & WHITNEY ENGINES
HIGHER H. P. RATINGS



This announces a complete series of new Pratt & Whitney engines, all carrying substantially increased horse-power ratings. All of these improved models are of the nine cylinder, single row, radial type. Built to meet the demand for increased aircraft performance, they embody basic Pratt & Whitney principles responsible for the phenomenal reliability of Wasps and Hornets. Aircraft engineers and manufacturers will find in these new engines increased power for high performance designs characterizing the most advanced airplane concepts of today. Specific information on these newly developed higher rated engines will be furnished promptly upon request.

THE
PRATT & WHITNEY AIRCRAFT CO.
EAST HARTFORD . . . CONNECTICUT, U. S. A.
Division of United Aircraft & Transport Corporation
Manufactured in Canada by Canadian Pratt & Whitney Aircraft Co., Ltd., Longueuil, Quebec; in Germany by Bavarian Motor Works, Munich; and in Japan by Nakajima Aircraft Works, Tokyo.

Say! The JACOBS ENGINE had a swell 1931 record...eh?
Sure! They're now in the new WACO. BIRD and SPARTAN models –
JACOBS
AIRCRAFT
ENGINES

ALL ENGINE . . . . and no frills . . . . .

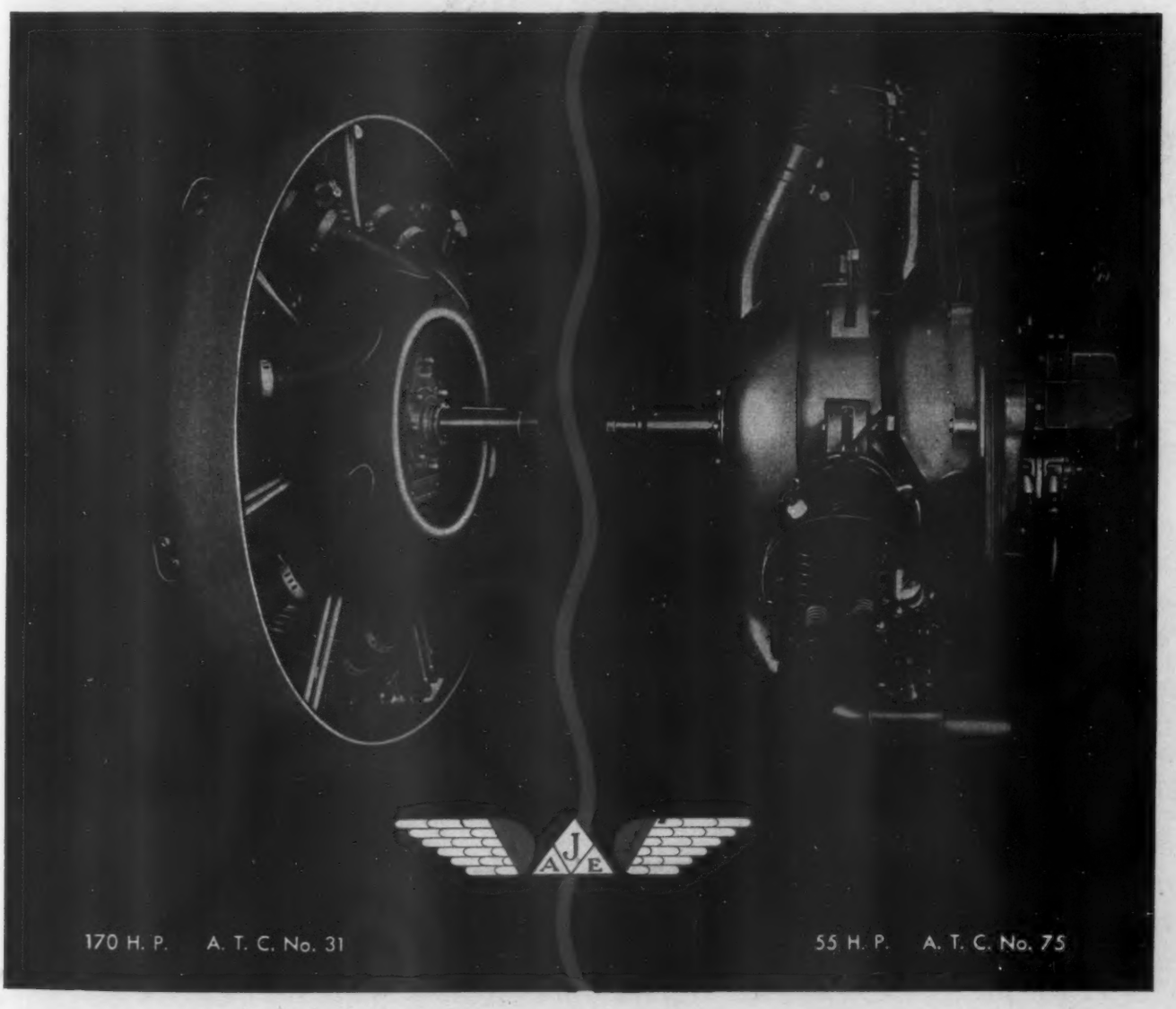
The Jacobs engine is simplicity itself. By concentrating on fundamentals and eliminating non-essentials Jacobs provides more ready accessibility and greater reliability. And simplicity keeps the price down. That's why Jacobs Engines offer outstanding performance at a reasonable first cost and with remarkably low maintenance costs.

Exclusively designed for cowling ring, the exposed rocker arms allow a Jacobs to be serviced more easily and quickly with cowling in place than the ordinary engine without cowling.

See the Jacobs Exhibit at the Show

JACOBS AIRCRAFT ENGINE CO.
CENTRAL AIRPORT
CAMDEN NEW JERSEY

JACOBS AIRCRAFT ENGINE



Master of "Blue Sky Land"

The
GREAT LAKES
Sport
Trainer
FOR 1932

COMMANDING, more than ever, the appraising attention of those who are serious minded about aviation. Providing, at less than $3,000, a proven ship that is trustworthy for all manner of cross country flights, yet unsurpassed in its suitability for training and instruction purposes.

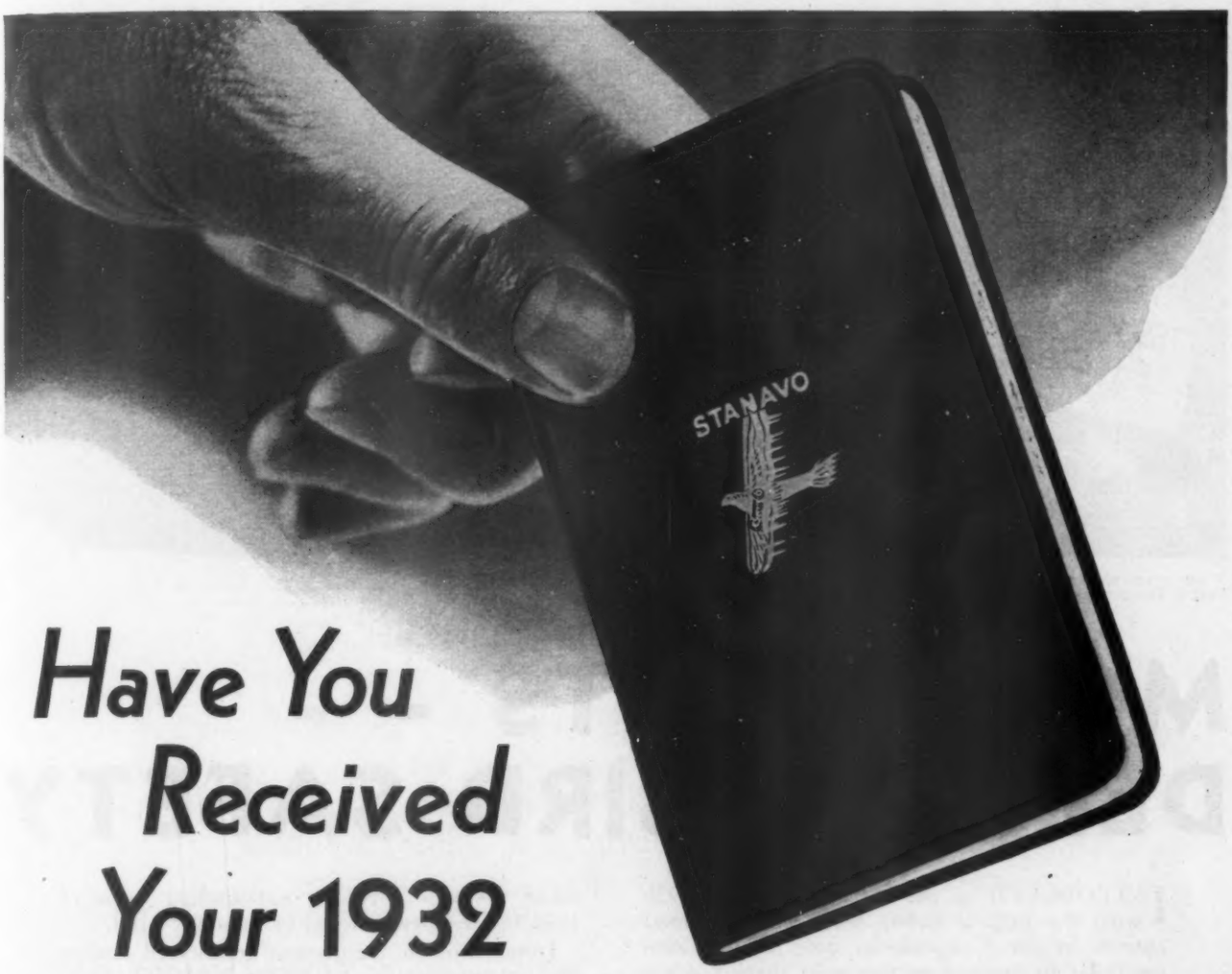
Use your own sense of values when you consider the Great Lakes Sport Trainer. For here is stability that you can depend upon. A plane that is both fast and maneuverable. Its responsiveness is a delight to everyone who flies. And the beauty of its streamlining bespeaks the master ship that it is . . no wonder Great Lakes owners are so proud of the planes they fly!

You should know, now, the three year record of this sparkling craft. Write today for a detailed description of the many refinements that have been engineered into the Great Lakes Sport Trainer for 1932. At $2985.00 it is the outstanding value of the industry!

GREAT LAKES AIRCRAFT
CORPORATION **CLEVELAND**
Contractors to the United States Army and Navy

LICENSED UNDER U.S. AIRPLANE PATENTS OF ALL MEMBERS

SEE THE OUTSTANDING GREAT LAKES EXHIBIT AT THE DETROIT SHOW



Have You Received Your 1932

STANAVO PILOT'S HANDBOOK?

The current edition of this convenient vest-pocket reference book is now being distributed. The original Handbook was published in 1929 as part of the broad Stanavo program of assisting in the advancement of aviation, and each of the three subsequent revised editions has been received with growing interest and enthusiasm by American pilots.

The 1932 Handbook includes data which pilots themselves have suggested in addition to information and data generously supplied by members of the aviation industry and by the Department of Commerce, Aeronautics Branch.

Copies are now being mailed to the best available list of licensed pilots. If for any reason you do not receive yours, the attached coupon is for your convenience.

STANAVO SPECIFICATION BOARD, INC.
Organized and Maintained by
STANDARD OIL COMPANY OF CALIFORNIA
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STANAVO SPECIFICATION BOARD, INC.,
Room 996, 26 Broadway, New York City.

Gentlemen: Date

I have not yet received my copy of the 1932 Stanavo Pilot's Handbook.

Name_____

Permanent Address_____

City_____ State_____

Airport_____ License No._____

Wiley Post and his 4-place 125 hp. Kinner-Bird. Post is the Bird distributor for Oklahoma and Texas.

MORE PILOTS - - DEMAND BIRD SAFETY

INTRODUCED to the air fraternity in 1928 with the highest rating among conventional entries in the Guggenheim Safe Plane Competition—in production now only three years—the Bird biplane in 1931 won second place in total sales in the 3-place open cockpit class and actually led all manufacturers of planes in that group in the fourth quarter of 1931.

Now recognized as the preeminently safe airplane for training — with a performance and economy record which has made it the choice of many of the country's leading amateur and professional pilots, the Bird in 1931 registered —in the face of a major business depression— a steady gain in popularity and a 10% increase in sales. Truly a significant record when measured by a 29% drop in sales for the industry as a whole.

And now Bird leadership in 1932 has been further emphasized by more than 50 improvements in construction details and equipment.

Performance, recognized safety and economy make the new Bird the outstanding value of 1932 for the professional or amateur pilot.

In addition to our present authorized dealers and representatives CURTISS-WRIGHT FLYING SERVICE, INC., has selected the Bird plane as being best in its class and has been authorized to represent us on Sales and Service throughout the United States through their thirty branches and 385 dealers.

To responsible Dealers and Distributors: The 1932 Bird line makes the Bird sales franchise the most attractive available today in its class and price range. Contact our representative at the Detroit Show or write the factory for full information.

The BIRD CHALLENGE

Over fifty recent improvements make the Bird line the most advanced among open-cockpit airplanes.

Bird planes invite comparison in performance with any others in their power range—including planes equipped with rotor vanes, slots, flaps or variable camber wings.

You are invited to learn the meaning of the Bird Challenge by actual demonstration at the Municipal Airport during the Detroit Aircraft Show.

SEE THE NEW BIRD MODELS AT THE DETROIT SHOW, DETROIT MUNICIPAL AIRPORT, APRIL 2-10

BIRD AIRCRAFT CORPORATION, Glendale, L. I., New York

BIRD

THE SAFE AIRPLANE

SPERRY AIRCRAFT INSTRUMENTS

SCHEDULES must be maintained and flown safely. It is, therefore, imperative that rugged and dependable flight instruments be provided.

The Sperry Horizon and Directional Gyro fulfil these requirements in every respect. They are direct reading flight instruments requiring no interpretation; are dead beat and permit of many hours continuous flying without "concentration fatigue."

Armies, Navies and Transport Companies all over the world, have purchased eight hundred and fifty-seven Sperry Horizons and Directional Gyros during the past eighteen months.

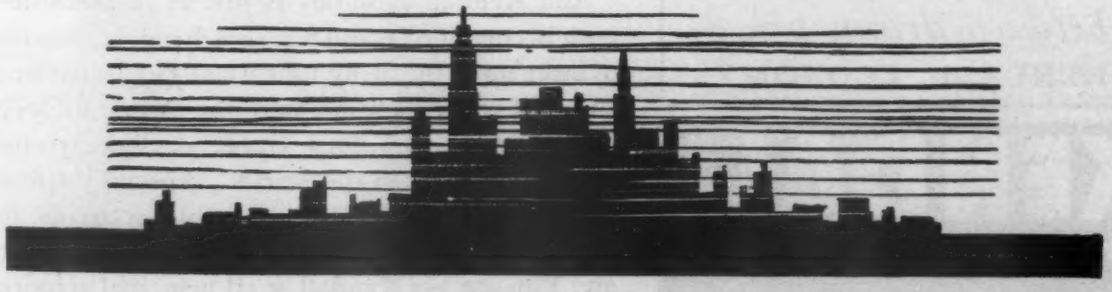
Visit our Booth No. 106 at the National Aircraft Show, April 2nd to 10th.

Catalogue will be sent on request.

SPERRY GYROSCOPE COMPANY

A DIVISION OF NORTH AMERICAN AVIATION INC.

BROOKLYN, N. Y.



These important records prove KENDALL PERFORMANCE

1931

Kendall wins 6 times as many prize awards as all other oils combined at National Air Races (Cleveland).

Kendall used in World's Long Distance Non-Stop Flight by Boardman & Polando (New York to Istanbul, Turkey, 5011.8 miles).

Kendall Wins First Place in Ford Reliability Tour FOURTH Consecutive Year.

1930

84.2% of All Prize Winners at National Air Races (Chicago) used Kendall Oil.

1929

80% of All Prize Winners in National Air Races at Cleveland used Kendall Oil.

1928

In New York to Los Angeles Derby over 60% of those who finished in all classes used Kendall Oil.

In the Los Angeles to Cincinnati Derby—*all finishers* in Class A used Kendall Oil.

. . . and 30 hours flying between drains prove KENDALL ECONOMY

KENDALL
THE 30 HOUR OIL

MERELY MAINTAIN THE PROPER OIL LEVEL

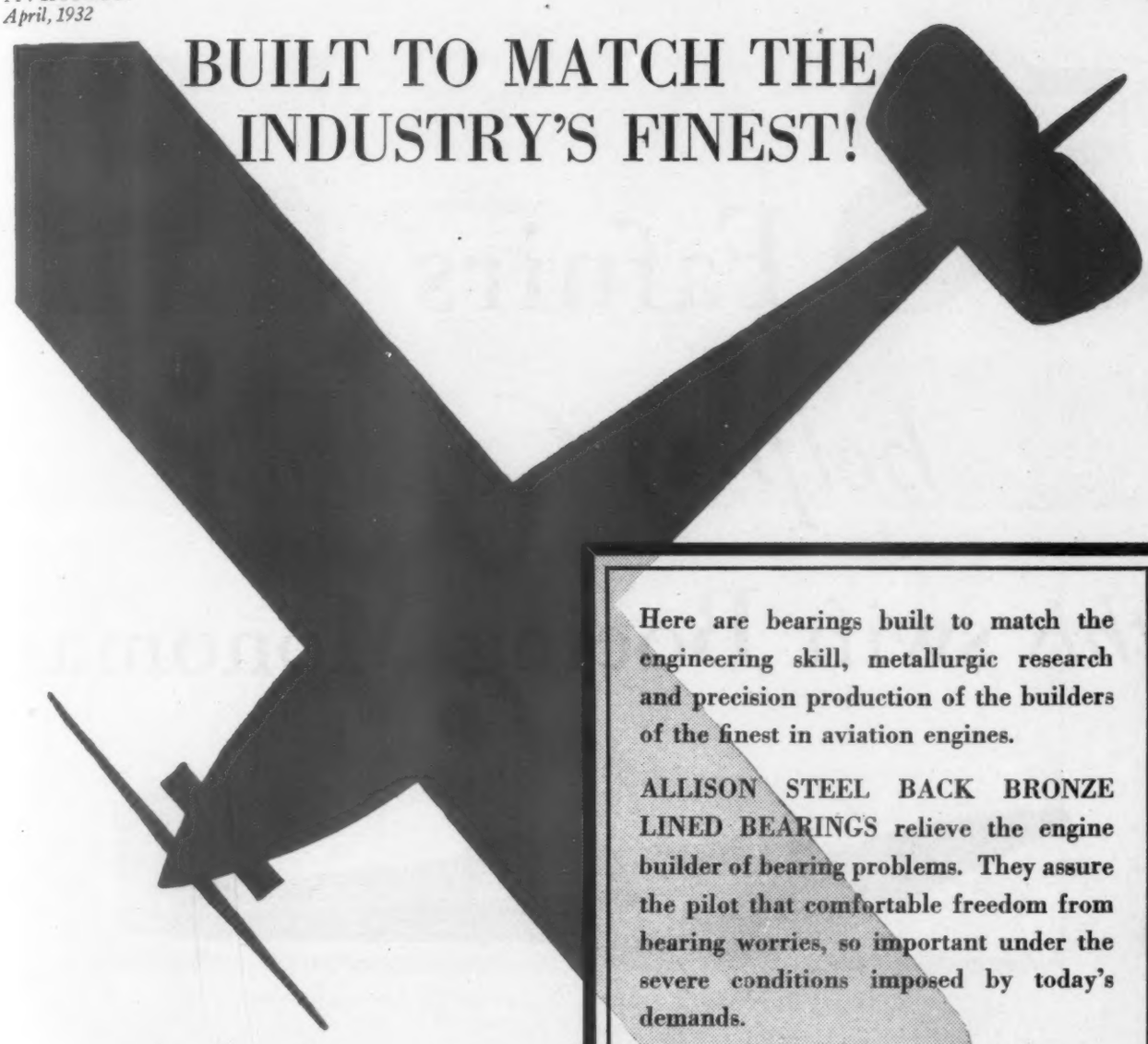
Kendall's overwhelming records of performance in National Events has increased each year against constantly greater competition . . . proving beyond doubt that Kendall Oil is the outstanding favorite wherever flying records are being made.

And Kendall economy is just as remarkable—both in commercial and pleasure flying. It gives two to three times the flying time usually expected from an oil, if you merely maintain the proper oil level.

Made from Bradford Grade of Pennsylvania Crude, the finest in the world . . . specially refined by extra Kendall processes—this accounts for Kendall's extraordinary performance and economy. You can get Kendall at all principal airports.

KENDALL REFINING COMPANY • Bradford, Pa.

BUILT TO MATCH THE INDUSTRY'S FINEST!



Here are bearings built to match the engineering skill, metallurgic research and precision production of the builders of the finest in aviation engines.

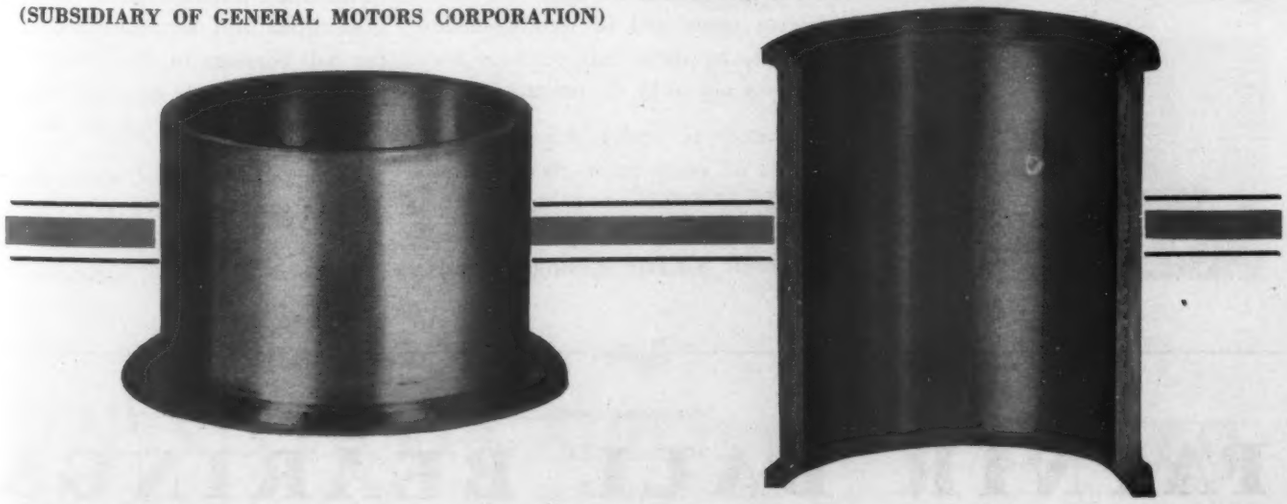
ALLISON STEEL BACK BRONZE LINED BEARINGS relieve the engine builder of bearing problems. They assure the pilot that comfortable freedom from bearing worries, so important under the severe conditions imposed by today's demands.

May we help solve your bearing problems as we already have done for the builders of many of the world's most powerful and dependable engines?

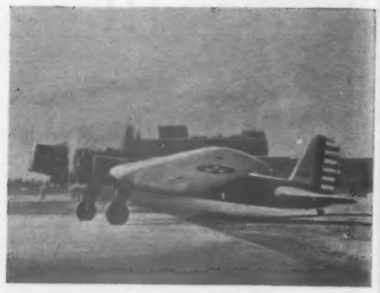
ALLISON
ENGINEERING CO.

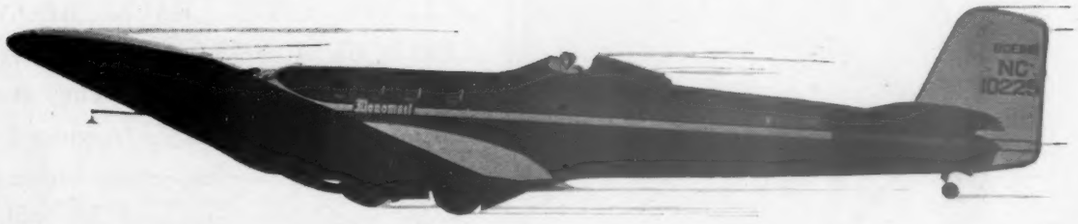
INDIANAPOLIS, INDIANA

(SUBSIDIARY OF GENERAL MOTORS CORPORATION)



58 Fafnirs *help to Control* *this* swift Boeing Monomail





SPEED with a heavy pay load are two important characteristics of this new Boeing. Smoother control is another and very important quality which has been attained through the use of 58 Fafnir Ball Bearings in the control mechanism.

Hand-in-hand with this smoother functioning is the elimination of costly servicing, an inherent quality of friction-free and wear-resisting Fafnirs. And in addition the saving in space and in weight made possible by these ball bearings are features not to be discounted.

Not only in costly ships, but in planes of every price, the practical benefits of Fafnirs are being utilized. The wide range of types and sizes of Fafnir Aircraft Bearings, including seal and cartridge designs, provides the correct bearing for every airplane service, for engines as well as controls.

Designers and builders find valuable information concerning load ratings, dimensions and recommended uses for ball bearings in the Fafnir Aircraft Data Sheets. As many copies as you need are free for the asking.

THE FAFNIR BEARING COMPANY,
NEW BRITAIN, CONN.

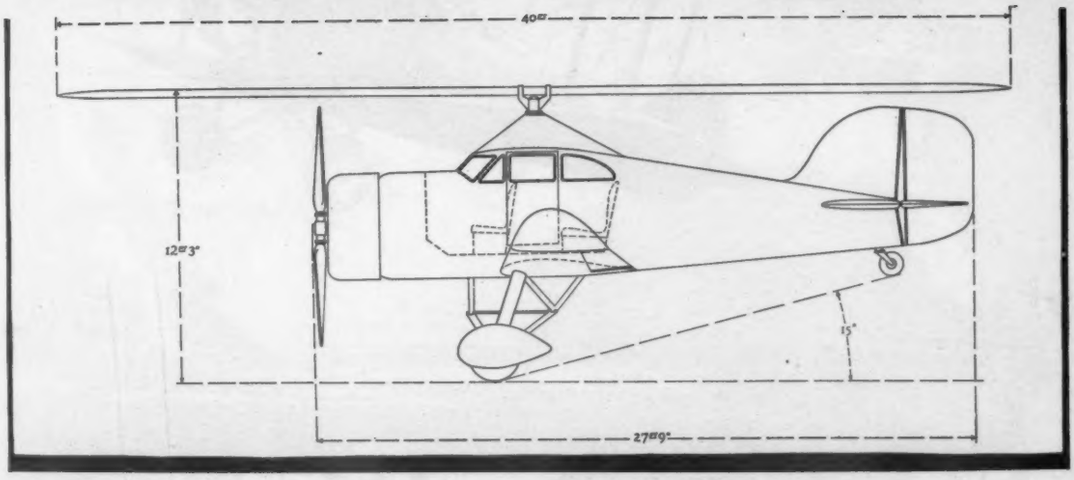
Atlanta Chicago Cincinnati Cleveland
Dallas Detroit Los Angeles Milwaukee
Newark New York Philadelphia

Safeguarding quality

FAFNIR BALL BEARINGS

No. 3, experimental machine 28 foot span and 1500 lbs. gross.

Pioneer flight under basic R. & K. Patents



Combination passenger and mail cabin-plane. Useful load 1500 lbs., 400 horsepower motor.

Announcement:

The Pennsylvania Aircraft Syndicate, Ltd. announces the issue of a basic patent on the rigid feathering "Gyroplane". The Gyroplane is a rotary wing aircraft which differs in principle from all other types, and has many advantages in performance, control, and cost of production.

The Gyroplane has been proven in flight.

An Improved and Different Rotating Air Foil System.

Advantages of the Wilford Gyroplane:

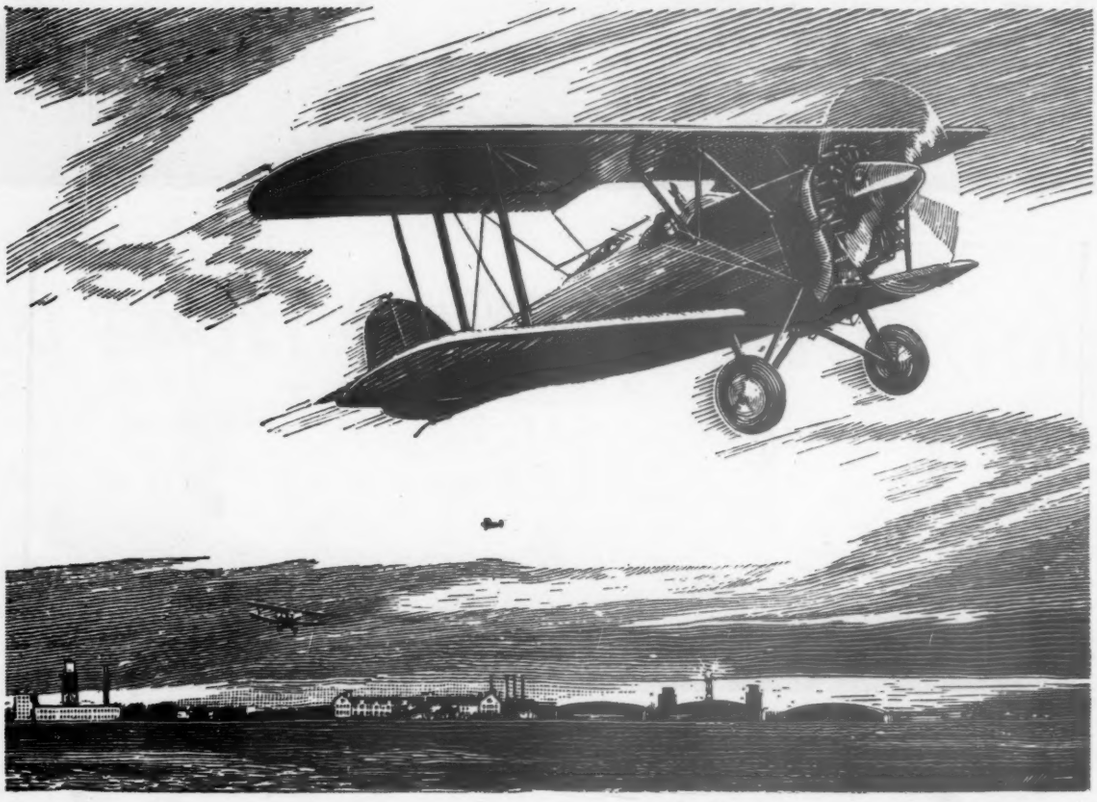
1. Rigid Feathering blades are used.
2. High lift airfoils effect small span of rotor.
3. Control in rotor for difficult descents.
4. Minimum parasite drag in cantilever blades.
5. Relation between maximum lift and minimum drag compares with modern wings.
6. Simplicity of structure means low cost of production and maintenance.
7. Smooth in flight.

Write for research information or rights to manufacture under the basic R. & K. German Patents, which fully protect the rigid system.

PENNSYLVANIA AIRCRAFT SYND. LTD.

WILFORD BLDG., PHILADELPHIA

OIL FAILURE *Steals Power— Shortens Motor Life! How to End It . . .*



FREQUENT overhauls, worn and scored parts, loss of power—blame them all on oil failure! When ordinary oil breaks down under heat and speed, up goes cost per air mile.

Tough-film Pennzoil—the oil that combats oil failure—increases the mileage on all moving parts, increases the period between overhauls, and insures longer motor life. And because it forms a tough film that resists heat, it gives many extra hours between refills—costs less per air mile.

100% PURE PENNSYLVANIA
PENNZOIL
SAFE LUBRICATION

Permit No. 2—*Pennsylvania Grade Crude Oil Ass'n*

THE PENNZOIL COMPANY

Executive Offices: Oil City, Pa.; Los Angeles, Cal.

British-American Oil Co., Ltd., Sole Distributors in Ontario and Quebec, Canada

PENNZOIL *is made by the famous Pennzoil Process from 100% pure Pennsylvania crude and nothing else*

RADIO: *Enjoy The Pennzoil Parade every Sunday evening over nationwide Columbia Network*

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The nation's air routes are "Scintilla equipped," every mile. Day in, day out, passengers and mail are transported by planes equipped with Scintilla Aircraft Magnetos.

SCINTILLA MAGNETO CO., INC.
SIDNEY, N. Y.
Contractors to the U. S. Army and Navy
(Subsidiary of Bendix Aviation Corporation)

AERONAUTICAL CHAMBER OF COMMERCE

DEPENDABILITY SIMPLICITY ACCESSIBILITY

© HOIT

SAFETY FIRST ASSURED—when your radio, lighting and ignition depend on this reliable Exide Aircraft Battery!

Exide
AIRCRAFT
BATTERIES

CONTRACTORS TO THE U. S. ARMY AND NAVY

. . . Exide continues to contribute to flying safety

AIR transport is more than twice as safe today as it was five years ago.* Largely responsible for this encouraging progress is the development of radio and, with it, instrument flying.

By making radio communication between plane and station more certain than ever, Exide Aircraft Batteries have contributed materially to flying safety. They are standard equipment on most of the large airlines.

This battery, safe and dependable beyond a doubt, is designed especially for aircraft service. It's light. It's compact. The electrolyte will not spill. Actual flight over millions of miles of airways has proved the reliability of Exide Aircraft Batteries for radio, lighting and ignition.

Find out why so many of your flying friends favor Exide. A postcard to us today will bring you full particulars by return mail.

* * *

*Figures show that in 1927 there was one fatality for about every two million passenger miles. By the second half of 1931 this record had risen to one fatality in about 4¼ million miles.

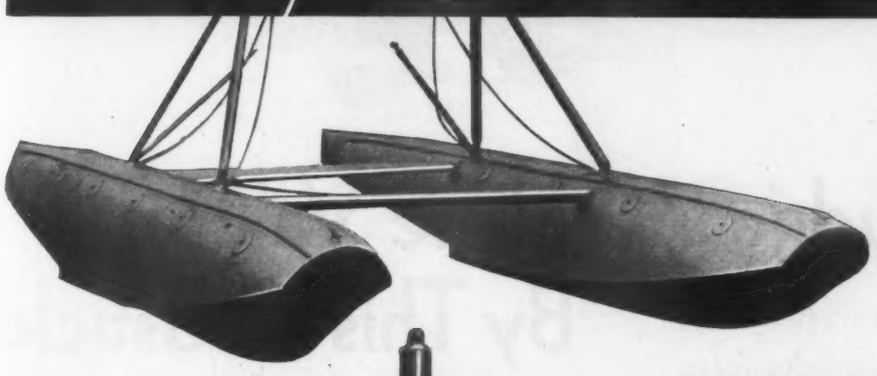
THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

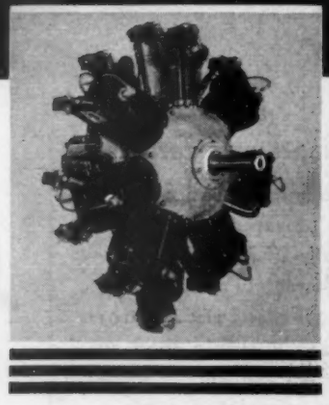
THE WORLD'S LARGEST MANUFACTURERS OF STORAGE BATTERIES FOR EVERY PURPOSE

Exide Batteries of Canada, Limited, Toronto

Announcing

A SERIES OF NEW PRODUCTS *by* WARNER





With the acquisition of the Aircraft Products Corporation, Warner now produces along with the well-known Warner "Scarab" Engines a complete new line of aircraft parts.

Warner's plant facilities are comparable to any in the entire industry. The consolidation of the two companies therefore makes an ideal set-up from the standpoint of both production and sales.

In addition to the 7 Cylinder, 110 H. P., and the 5 Cylinder, 90 H. P., Warner "Scarab" Engines, we are now in a position to furnish to the industry the following products:

Airplane Wheels and Brakes; Axles and complete Under Carriages; Oildraulic Shock Struts, Tail Wheel Assemblies; Airplane Skis; Pontoons; Flying Boat Hulls; and Wing Tip Floats.

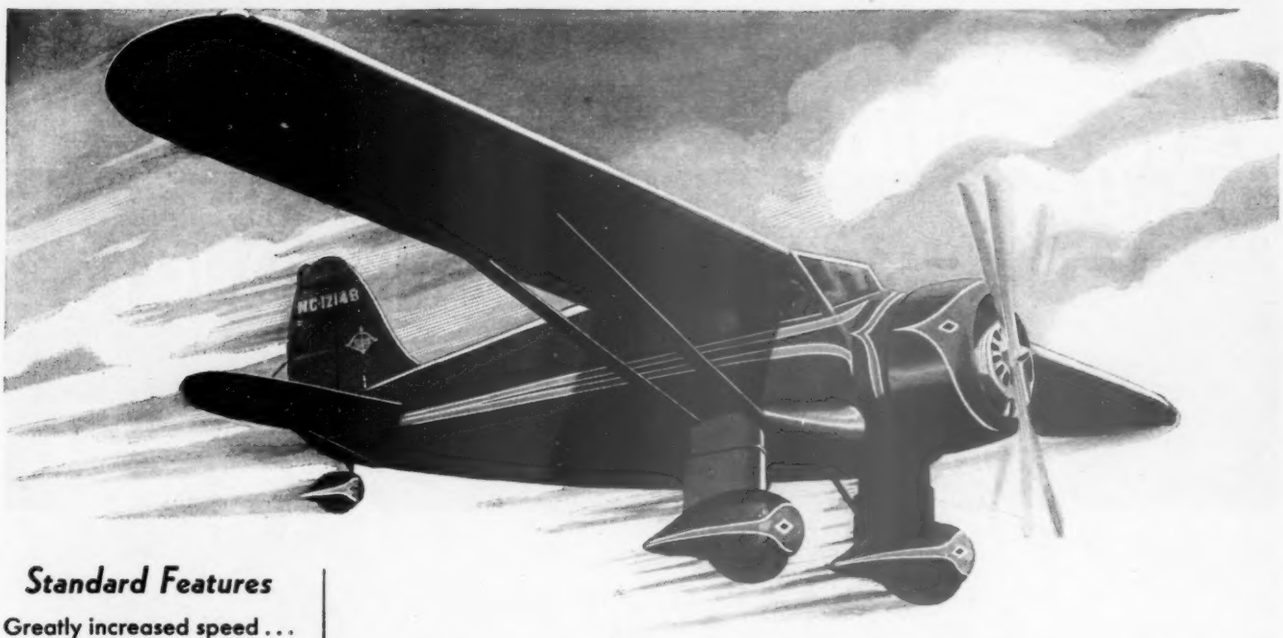
Reflected in all of these various products is the experience gained in engine building practice. Precision workmanship of a high order enters into every phase of Warner construction.

We will also design and build, or build from your own design, various other parts and special fittings.

We will welcome your inquiries.

WARNER AIRCRAFT CORPORATION
DETROIT, MICHIGAN

WARNER *"Scarab"* ENGINES



Judge Airplane Values By This Yardstick

There is no mystery about how to measure the value of an airplane. The same common sense rules that apply in measuring other products are applicable to airplanes. Careful analysis proves that the ideal airplane is the one which offers the greatest degree of Safety, Economy, Stability, Speed, Comfort, and Beauty at the lowest first cost and thereafter at the lowest cost per mile. Stinson does not offer one advantage at the expense of others but is designed and built to be the best COMBINATION of ALL the factors that constitute airplane value. Regardless of price, we believe the new Stinson Model R offers the best combination of all the vital qualities that has ever been produced. We invite you to fly it and convince yourself that it is marvelously stable; that any normal person can fly it safely; that it will land and take off in small fields; that its reliable 215 H.P. Lycoming motor is economical to operate; that it is as comfortable and as finely finished as a good car, and that it has beauty of line and exterior finish of which you may well be proud.

Then compare its low price with any other airplane on the market. You will find that the Stinson Model R is your logical choice.

If you are considering the purchase of an airplane, won't you write or wire us today so that we may present the Model R for your inspection?

Standard Features

Greatly increased speed . . . high powered performance, greatly increased economy . . . completely streamlined . . . greater safety . . . more inherently stable than any previous Stinson . . . larger, roomier insulated cabin . . . V-type windshield . . . shatter-proof safety glass windows . . . electric starter . . . adjustable metal propeller . . . self-energizing brakes . . . hydraulic shock absorbers . . . cabin heaters . . . ventilators . . . parking brakes . . . adjustable stabilizer . . . pants or fender pants optional on all wheels . . . navigation lights, map pockets, ash receivers, assist cords . . . dual wheel controls . . . speed cowling ring on motor . . . . cruising speed 110 miles per hour at 1800 revolutions . . . high speed 130 miles per hour . . . rate of climb, loaded, 675 feet per minute . . . cruising range 400 miles . . . gas capacity 56 gallons . . . ceiling, loaded, 13,000 feet . . . wing spread, 43 feet 3 inches . . . length, overall, 25 feet 10 inches . . . capacity, four persons and baggage.

$5595 f. o. b. Wayne, Mich.

Equipment other than standard, extra

STINSON AIRCRAFT CORPORATION, WAYNE, MICHIGAN
Division Cord Corporation

More Than Ever "The Aircraft Standard of the World"

MONUMENTAL

An airplane equipped with Bendix Wheels and Brakes is a *safer plane.*

Here is a monumental contribution. Not stopping there, our staff of engineers continue to add, improve, make better yesterday's best. Their latest improvement has brought forth the new Bendix Roller-Bearing Wheels.

A logical conclusion then — every aircraft maneuver that brings wheel and brake into play is performed not only more *safely,* but *better* — thanks to Bendix Airplane Wheel and Brake equipment.

BENDIX BRAKE COMPANY
SOUTH BEND, INDIANA
(Subsidiary of Bendix Aviation Corporation)

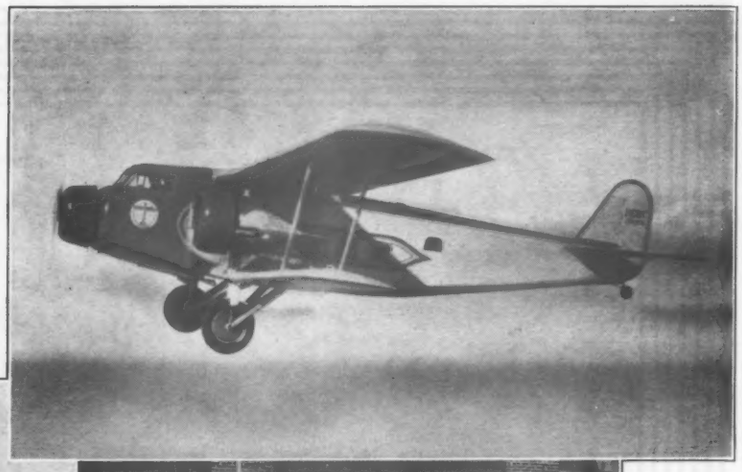
BENDIX FOR AIRPLANE WHEELS *and* SAFETY **BRAKES**

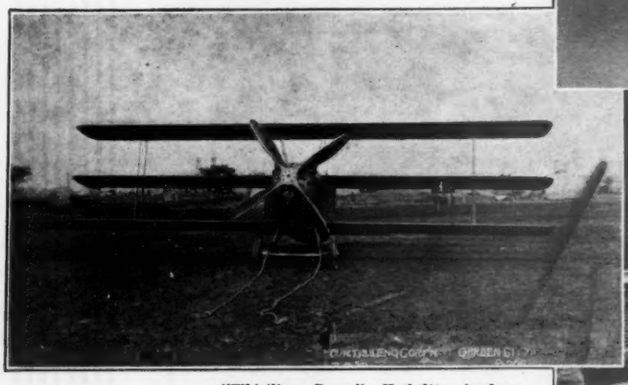
FULLY PROTECTED BY PATENTS AND APPLICATIONS IN U. S. AND ABROAD

Air Mail Saves Time

. . . since the days of the
"WHISTLING BENNY"

At right—A Haskelite equipped Boeing.





"Whistling Benny" Haskelite fuselage.

A wartime Haskelite fuselage.

15 years of specialization & leadership!

In 1917, the Haskelite Manufacturing Corporation was organized for the purpose of supplying aircraft plywood to the United States and her allies. At that time we were the only manufacturer specializing in aircraft plywood.

Today, fifteen years later, there are as many as 57 varieties of ply wood used in aircraft, but there is only one quality plywood—there can be but one leader—that plywood is HASKELITE. There is still only one company specializing in aircraft plywood—we are that company.

In a national emergency the entire plant of the Haskelite Manufacturing Corporation would be available for the production of aircraft plywood. In such an emergency, our daily capacity could be stepped up to 150,000 square feet per day. No other manufacturer has such a potential production of aircraft plywood.

Since the World War and the days of the "Whistling Benny" we have had faith in the aircraft industry. We have always supported the industry and all of its activities. As usual, we shall exhibit at the Detroit Aircraft Show. Visit our Booth, Space 97.

TRAVEL BY AIR HASKELITE USE AIRMAIL

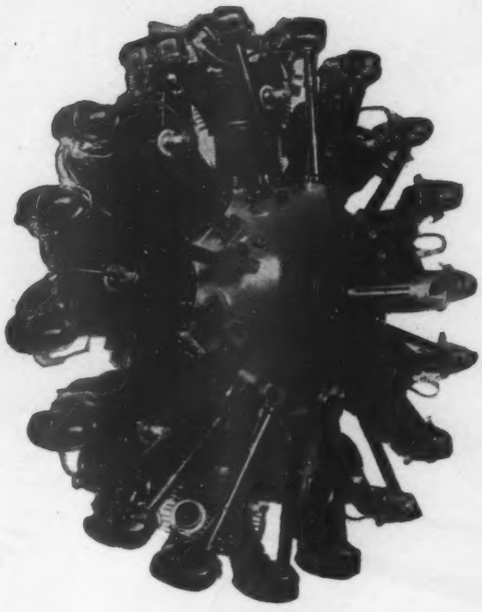
Space 97 at the show

HASKELITE MANUFACTURING CORPORATION

120 SO. LA SALLE STREET CHICAGO, ILLINOIS

In Canada: Railway and Power Engineering Corp., Ltd.

ACHIEVEMENT
LYCOMING AIRCRAFT ENGINES



POWERED BY LYCOMING

Model R-680
Lycoming nine-cylinder, radial aircraft engine

A RECORD UNEQUALLED

Since its first installation in 1929, this Lycoming nine-cylinder radial engine has powered more four to ten-passenger cabin planes than all other makes of engines combined.

Consider these evidences of overwhelming preference for aircraft powered by Lycoming:

Of the 331 commercial aircraft engines in the 176 to 225 h. p. class sold during 1931, Lycoming sold 285 or 89%.

At the present time, Lycoming Aircraft Engines are being flown upwards of 75,000 miles daily (more than 3 times around the world) 27,000,000 miles per year on air lines in this country. Recently one company flew 3,000,000 engine miles without an engine failure, using Lycoming engines.

Today more than 40% of the average daily air passenger traffic is carried in Lycoming-powered planes.

There are more, modern four-passenger cabin planes (powered by Lycoming) in use than all others combined.

The U. S. Army Air Corps recently selected Lycomings for their training planes because of their performance, dependability and long life.

Write for literature and detailed information.

Lycoming Aircraft Motors will be exhibited at the National Aircraft Show, Detroit, April 2 to 10

LYCOMING MOTORS

LYCOMING MANUFACTURING COMPANY, WILLIAMSPORT, PA.

For Dependability use a WILLARD

Just as millions of motorists have come to know they can depend on the Willard batteries in their cars . . . so on the network of air lines that covers the nation, Willard Aircraft Batteries have won the confidence of operators and pilots everywhere. « • » Whenever you need a dependable aircraft battery . . . specify Willard.

Willard builds a complete line of "NON-SPILL" aircraft batteries at a wide range in price, including those with Thread-Rubber Insulation, an exclusive Willard product.

STORAGE BATTERIES

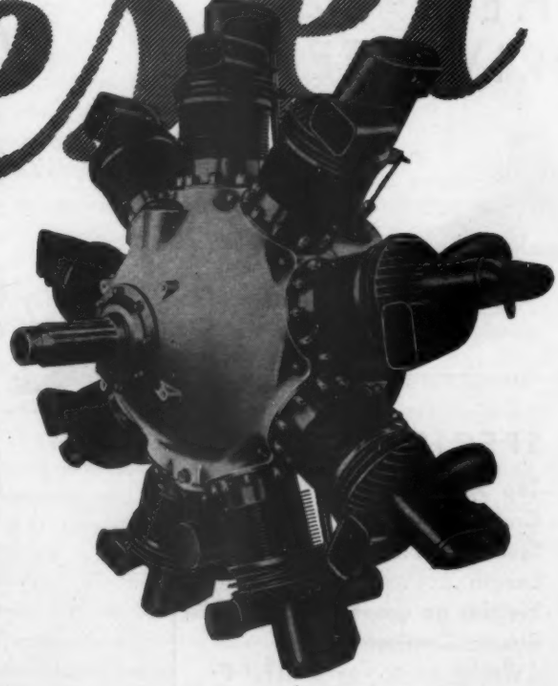
Willard

WILLARD STORAGE BATTERY COMPANY • *Cleveland* • *Los Angeles* • *Toronto, Ont.*

Announcing

AVIATION'S FIRST *free wheeling* ENGINE

THE GUIBERSON *Aero-Diesel*



Granted Approved Type Certificate No. 79 by U. S. Department of Commerce in February, 1932 . . . Perfected after extensive research and experiment . . . Backed by a grand old name among manufacturers of equipment for the Oil Industry . . . Manufacture in commercial quantities soon to begin.

OUTSTANDING FEATURES: 1. One-throttle control, automatically synchronizing timing and fuel injection. 2. Complete decompression allowing "free wheeling" of propeller with motor dead. No diving to re-start motor. 3. Operation at fuel cost of one cent per mile. 4. Elimination of fire hazard. 5. No radio interference. 6. Simplicity.

ON DISPLAY AT THE

NATIONAL AIRCRAFT SHOW

BOOTHS 27, 28, 29 and 30 at intersection of
Transcontinental and Western and United Airways

THE GUIBERSON DIESEL ENGINE COMPANY, DALLAS, TEXAS

GUIBERSON

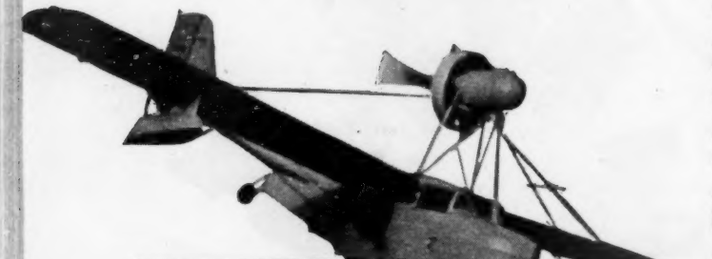
BETTER BE SAFE THAN SORRY

Aero-Diesel

AT LAST!

A high-performing cabin amphibion for less than $10,000

THE 1932 PRIVATEER III



SPECIFICATIONS

Top Speed	120 m.p.h.
Cruising Speed	100 m.p.h.
Span	42′ 5″
Length	30′
Height, on ground	11′ 7″
Power: Continental R-670	215 h.p.

New type Townend Ring, Heywood Injection Starter, Low Pressure Tires, Fuel Level Gauge, Tachometer, Oil Thermometer, Altimeter, Air Speed Indicator, Compass, Tools, Anchor, Rope, Fire Extinguisher.

AMPHIBIONS, INC., scoops the 1932 market . . . producing the first high-speed cabin amphibion selling for less than $10,000. Conservatively speaking, the new PRIVATEER III will outperform any other single-engined amphibion in the country. Powered with Continental's latest—the 215 h.p. R-670—it does 120 m.p.h. And in appearance—it's a beauty. ¶ The business man, sportsman, flying school and commercial operator will find this up-to-the-minute three-place cabin amphibion made to order for his particular use. Aerodynamically it reflects the pioneering work of Amphibions, Inc., in the field of land-and-water aircraft. ¶ Utility is supplemented by comfort throughout. The well-appointed cabin seats three with ample head and leg room. The cabin is sound-proofed and equipped with adjustable ventilators, sliding windows, windshield wipers, dual controls, etc. A novel door arrangement provides easy entrance and exit from either side. ¶ The PRIVATEER III will appeal to the technical-minded. For instance, the simplified and automatic positive-action landing gear retraction. The non-corrosive hull structure, fabric covered. The new wing tip floats with shock absorber equipment. The insulated engine mount. The unusual visibility obtained by placing the pilot before the leading edge of the wing. ¶ Designed to meet a real demand, dealers will recognize the sales possibilities of this most modern of all cabin amphibions.

Be sure to see it at the Detroit Show—Spaces 4, 6 and 8—Eastern Airway

AMPHIBIONS, INC.

GARDEN CITY LONG ISLAND, N. Y.

"Believe It Or Not—

When Commercial Aviation Standardizes Its Schedules to Railroad Accuracy, Pilots Will Carry 16-Size Railroad Watches—And Ten Chances to One Their Choice Will Be the New ELINVAR 992 HAMILTON"

" Then, and then only," continued a high railroad official who is intensely interested in air passenger transportation, " will the pilots be able to enjoy the maximum safety from the marvelous radio telephone systems that now keep flight pilots on schedule and in touch with ground operators along the route."

When American railroads were in their infancy, timetables were so complicated that it took a C. P. A. to figure them out. Each community had its own sun-time and train runs had to be adjusted to the time used in the localities through which they passed. This transportation problem led to the establishment of our present four standard time belts in the United States.

The new time belts made it easy to lay out train schedules *on paper* — but still, travel by rail was an uncertain and dangerous undertaking. Many fatal wrecks occurred because trainmen lacked accurate and dependable timepieces with which to carry out their orders and follow time schedules.

But the developing railroad industry met this emergency by adopting standard specifications for the watches carried by train crews. They specified a sixteen size, 21 jewel, lever-set American watch that would keep time with a maximum variation of thirty seconds a week. A system of time inspection was established and official watch inspectors were appointed by the railroads to see that the watches were kept up to standard. Watches that failed to pass inspection were condemned — and the employee either got a new watch or the railroad got a new employee. Railroad men were cautioned, under penalty of dismissal, not to change the setting of their watch between inspections. Their duty was to wind their watches daily and have them cleaned and oiled when ordered to do so by the inspector.

***Then came Hamilton* — a watch designed to meet railroad specifications. It won immediate preference and its reputation as the Watch of Railroad Accuracy is based on performance through forty years of railroad service.**

Now we present a watch for modern transportation — the Hamilton 992 *Elinvar* — the *only* watch which successfully resists magnetism and remains unaffected by sudden temperature changes. Moisture cannot ruin the tiny hairspring because it is made of a marvelous new rust proof alloy known as Elinvar. The Hamilton Watch Co. has sole American rights for the use of Elinvar in precision instruments.

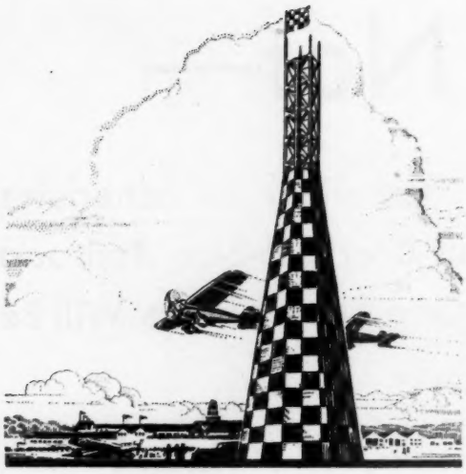
We firmly believe that aviation will soon realize the value of a time inspection service — adopting aviation standards for watches to be carried by the crews of aerial transports. Such a service means added safety — on-time schedules which will encourage the use and development of an industry destined to become a major medium of transportation in America.

Let us send you our booklet about the Hamilton 992 Elinvar. You'll be surprised to learn how closely this watch will meet your time requirements. Write for a copy of " Elinvar In Your Watch." Address, Department A, Hamilton Watch Co., Lancaster, Penna.

★ ★ ★ ★

HAMILTON

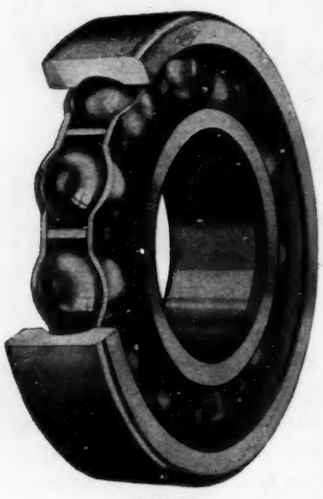
The Watch *of* Railroad Accuracy



S R B
ROCKER ARM BEARINGS
Full type ball construction without cages. One side shielded.

SRB BALL BEARINGS

proved by millions of flying miles



S R B
MAXIMUM CAPACITY SINGLE-ROW
Has greatest radial capacity which can be incorporated into a single-row bearing of well balanced design.

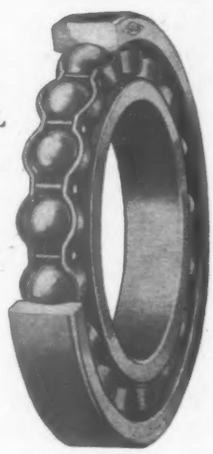
•

SRB Aviation Ball Bearings are used more extensively in aircraft engine service than any other make. Such manufacturers as Continental, Curtis, Jacobs, LeBlond, Lycoming, Pratt & Whitney, Warner and Wright are users of SRB Ball Bearings. This predominance is due to their inherent quality as demonstrated through millions of miles of dependable flying service.

The SRB design includes deep grooves in the raceways conforming closely to the ball contour. It contains the maximum number of largest possible balls consistent with structural strength of the races. Balls are hot forged from Molybdenum Steel. Ball retainers are of the riveted stay-rod type. This combination of features not found in any other ball bearing gives the absolute maximum in radial and thrust capacity and durability.

SRB Engineers with their years of experience in the Aircraft Industry are available for consultation on your bearing problems.

S R B
TYPE "V" AVIATION BALL BEARING
Exceptionally high capacity—saving 13.8% to 26.6% in weight.



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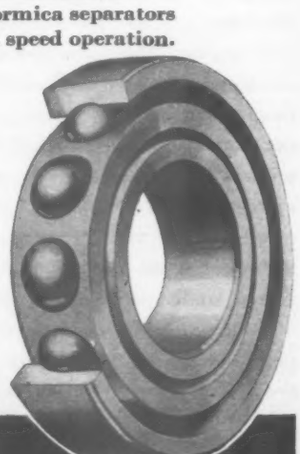
M-R-C
SUPER-CHARGER BALL BEARINGS
With Formica separators for high speed operation.



STANDARD STEEL AND BEARINGS INCORPORATED
DIVISION OF MARLIN-ROCKWELL CORPORATION
Plainville ***Connecticut***

Ball SRB AND M-R-C Bearings

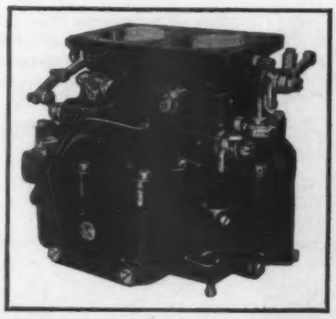
Photo by Fairchild Aerial Surveys, Inc.

Linking the Americas

HIGH above the Hudson's waters, the flagship of Pan American Airways circles in final salute to Gotham as she noses toward the Carribean.

This 45 passenger Sikorsky is the largest amphibian in the world. Linking the Americas is her regular job. And since her maiden voyage with Col. Lindbergh at the controls, she has performed it dependably, trip after trip.

Every flight the American Clipper makes is a Stromberg responsibility. Four Stromberg Carburetors supply the fuel mixture for her engines—2300 horsepower total. An outstanding example of Stromberg dependability contributing to Pan American dependability.



Stromberg NA-Y8C Carburetor double barrel type. Weight 15 pounds. Barrel diameter 2 15-16 inches. Capacity (approximate) 650 H. P.

The American Clipper is but one of many Pan American planes—all types—that depend on Stromberg Carburetors. In fact, 95% of the planes flying in the United States today are Stromberg-equipped.

If you have a carburetion problem, let us know. Our engineers would like to coöperate. There is a Stromberg Carburetor for every type and size of plane.

There are four of these carburetors on the ship shown in the photograph

STROMBERG CARBURETORS

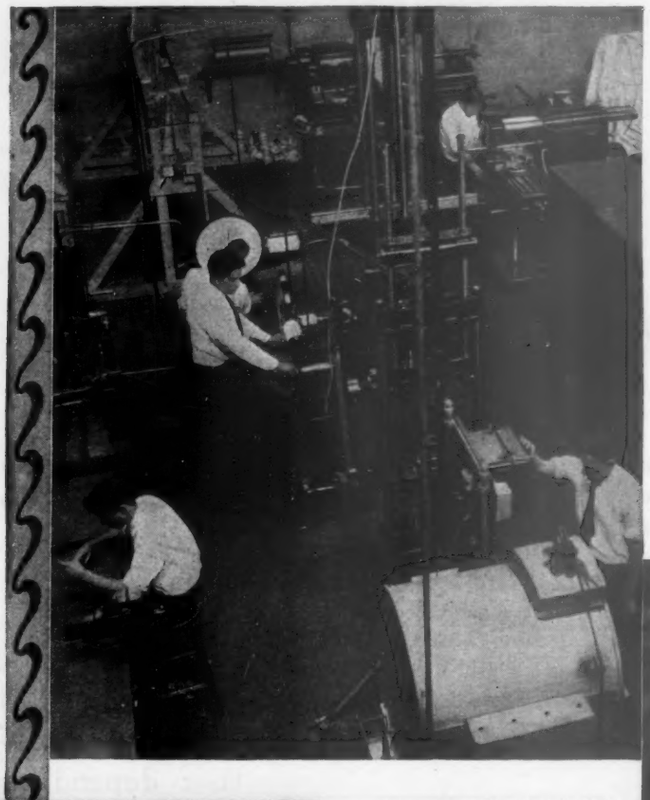
BENDIX STROMBERG CARBURETOR COMPANY

« SUBSIDIARY OF BENDIX AVIATION CORPORATION »

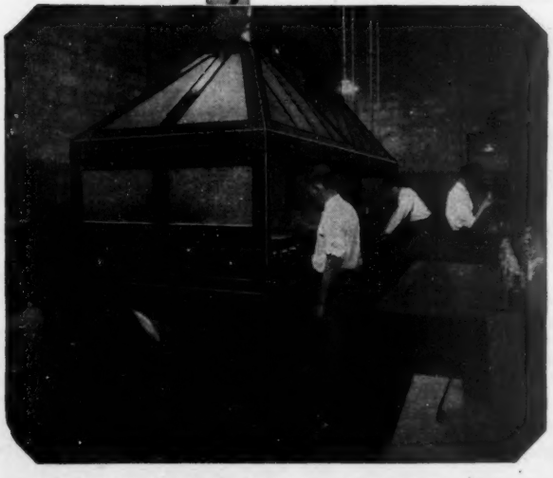
701 BENDIX DRIVE, SOUTH BEND, INDIANA

LEADING IN DEPENDABILITY

Martin Military Airplanes—the product of advanced engineering, coupled with progressive shop methods and thorough laboratory testing of all materials



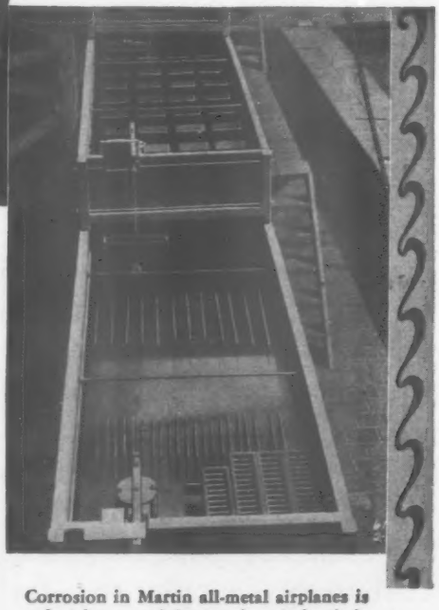
Static tests prove design and insure safety. The above photograph shows a static test of wing leading edge section sustaining a load of more than 2,000 pounds. All other parts are as carefully tested.



Above—The Martin Physical Laboratory, equipped with the most modern testing apparatus available, continually checks for quality and strength all material used in Martin planes.

★ ★ ★

Left—Ferrous and non-ferrous metals, paints, fabrics, and other materials which must meet our rigid material specifications, are analyzed in this modern Chemical Laboratory before acceptance for use in fabricating parts.



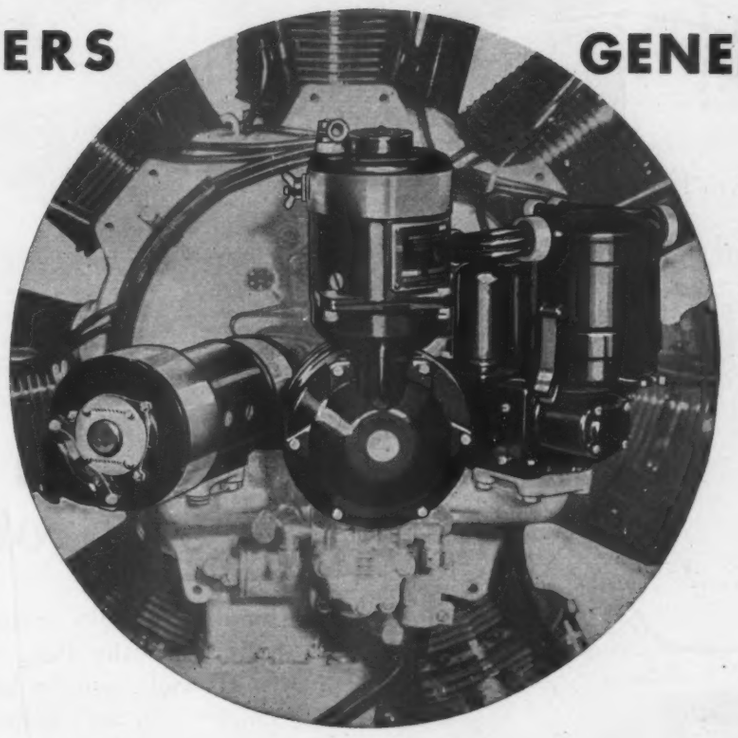
Corrosion in Martin all-metal airplanes is reduced to a minimum—the result of six years of successful research by Martin Engineers. The equipment pictured above subjects "assemblies" to sea water and sunlight tests far more severe than service conditions.

THE GLENN L. MARTIN COMPANY, BALTIMORE, MD.

BUILDERS OF DEPENDABLE AIRCRAFT SINCE 1909

now!
BATTERY IGNITION

STARTERS GENERATORS



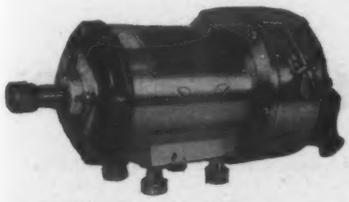
for smaller aircraft engines

Delco Aviation Ignition Unit

The coordinated engineering organizations of several units of the Bendix Aviation Corporation have been engaged for some time in developing battery ignition equipment for aircraft engines.

As a result thereof, Delco Aviation Ignition is now offered as companion equipment to Eclipse Starters and Generators—especially in combinations particularly suited to the requirements of smaller aircraft engines.

Eclipse direct cranking electric starter, type Y-150, for engines up to 450 cu. in. piston displacement.



Eclipse Aviation Generator

DELCO
AVIATION IGNITION
Manufactured by
Scintilla Magneto Co., Inc.
Sidney, N. Y.

ECLIPSE
STARTERS · GENERATORS
Manufactured by
Eclipse Aviation Corporation,
East Orange, N J

(Subsidiaries Bendix Aviation Corporation)

PAA

Pan American Airways—The Merchant Marine of the Air—covers 20,166 miles of airways and links thirty-one countries and colonies of the Western Hemisphere to the United States. This necessitates 13,000 miles of over-sea flying, 600 of which is non-stop across the Caribbean Sea.

The American Clipper arrives at Havana two hours after leaving Miami

Pan American has an "on-time" arrival record of 99.62%

The 102 multi-motored, radio equipped, passenger, mail and express airliners in the Pan American Fleet serve ninety-four airports and seaplane bases. There are fifty-six private ground radio and weather stations. To date, operations cover 29,000,000 passenger miles flown; 104,000 passengers carried; 5,300,000 pounds of air mail and cargo transported with an "on time" arrival record of 99.62%.

The flagships of the fleet are the giant Sikorsky S-40's, American Clipper and Caribbean Clipper. These are the largest ships of the kind in regular service on any air line. They carry forty-five passengers and a crew of five. Each ship is powered by four Pratt & Whitney Hornet engines.

Pan American covers one of the most interesting airways in the world. Its ships are called upon to do almost miraculous things. They must fly from water level to more than mountain heights. They must top the Andes and undergo a temperature change of from 90° above to 30° below zero —120 degrees—in one hour. In all flying operations perfect spark plug performance is vital—that's why Pan American uses B. G. Mica Aviation Spark Plugs.

Patented in the United States and other countries

The B. G. CORPORATION

Contractors to the United States Army and Navy and Aircraft Engine Builders

136 West 52nd St., N. Y. Cable Address: Golsteco, New York

WHY THE LUDINGTON LINES CHOSE FLEETSTERS

GUIDED by the records of 2,080,634 miles flown in transporting 87,520 passengers on a schedule of twelve round trips daily, and convinced by seventeen months' contact with the men and women who fly regularly and frequently between New York, Philadelphia, and Washington—The Ludington Airlines, Inc., chose 1932 model FLEETSTERS... because they fulfill the demands of air travelers for comfort and convenience... because they afford lower maintenance and operation costs... and because they carry nine passengers and more than 400 pounds of baggage at a cruising speed of 160 miles an hour.

CONSOLIDATED AIRCRAFT CORPORATION · BUFFALO · N · Y·

Do you know that . . .

each month our subscription department receives more than 150 requests for "Back" issues of AVIATION?

◆ ◆ ◆

If we printed extra copies of our monthly issues, we would be glad to comply with these requests, but unfortunately we have no way of knowing in advance just how many of our newsstand readers will "miss" an issue.

◆ ◆ ◆

But We Do Know **— that each of these requests indicates a reader has "missed" just the issue he could make valued use of.**

Insure your receiving AVIATION *regularly by filling in the coupon below, today . . . .*

AVIATION
330 W. 42d St.
New York City

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Subscription Rates:
United States and Mexico, $3 a year;
Canada (including Canadian duty), $3.50 a year;
Central and South America, $6 a year;
All other countries, $8 a year.

Here is my check for $3.00. Send me Aviation for one full year.

Name .....

Address .....

City and State .....

Nature of Activity .....

$1325
F. A. F.

"THE CUB" — TAYLORMADE

High costs, both initial and operating, have kept many air-minded persons from buying airplanes. "The Cub" solves the high-cost problem—it is a real airplane, at low cost.

Lack of flying fields has deterred business men from purchasing. "The Cub" is the answer to this problem also. Its low landing speed (an honest 26 m.p.h.) and the remarkably short run at take-off make it possible to use a small clearing or field for landing purposes.

Fear of landing accidents has been sufficient reason to bar the 'plane as a means of family transportation and sport. Here again "The Cub" does away with objections. "Cubs" are in service from Ottawa to Southern Florida, used largely for student instruction; there has never been a serious crack-up in the 9 months the "Cub" has been on the market.

Every "Cub" we have turned out is in active service except just one; this was taxied into while warming up on a field in New York City.

Gasoline consumption is only 2½ gals per hour.

DEALERS

Here's your opportunity. Sell "The Cub" to the sportsman; to the business man; to the family; for student instruction (Schools can charge less because costs are so low. Enrollments are large; one operator reports he has 66 students). This is a profitable field. "The Cub" does sell. We've proved it. It is good. It makes good. Send for complete details.

Maintenance is low
Delivery charges are little
Excellent Vision
Continental A-40 engine
A.T.C. No. 455
Flyaway Field price $1325.
Send for complete specifications.

TAYLOR AIRCRAFT COMPANY

BRADFORD, PA.

Look for STABILITY *in your school as you would in your plane*

BOEING SCHOOL of Aeronautics is a permanently established institution. It was created to meet the need for highly trained pilots and mechanics that must accompany the continued development of air-mail flying and passenger transport.

This school is a division of United Aircraft and Transport Corporation—a part of the same system that includes United Air Lines (flying 35,000 miles daily), Pratt & Whitney, the Boeing Companies, Stearman, Hamilton Standard, Chance Vought, Sikorsky and other companies which represent the utmost in stability of aviation products and operation.

Boeing graduates outnumber those of other schools operating today in the record of their employment by important air lines and manufacturers. To become a Boeing graduate means that the highest standards of commercial training developed in America have been successfully met.

For bulletin giving detailed descriptions of courses, entrance requirements, et cetera, fill out and mail the coupon below. Compare Boeing instruction and facilities with those offered elsewhere before choosing your school.

Next regular enrollment, July 5, 1932.

Six-week courses in Airplane and Engine Mechanics offered in the July quarter.

BOEING
SCHOOL OF AERONAUTICS
Subsidiary of United Aircraft & Transport Corp.

BOEING SCHOOL OF AERONAUTICS
Room B-4, Airport, Oakland, California

Gentlemen: I am interested in

☐ Private Pilot ☐ Boeing Master Pilot
☐ Limited Commercial Pilot ☐ Boeing Master Mechanic
☐ Transport Pilot ☐ Special Master Pilot
☐ Six-week Summer Courses (For Transport Pilots)

Name_____ Age_____
Address_____
City_____ State_____

VISIT OUR NEW GENERAL OFFICES DURING THE NATIONAL AIRCRAFT SHOW

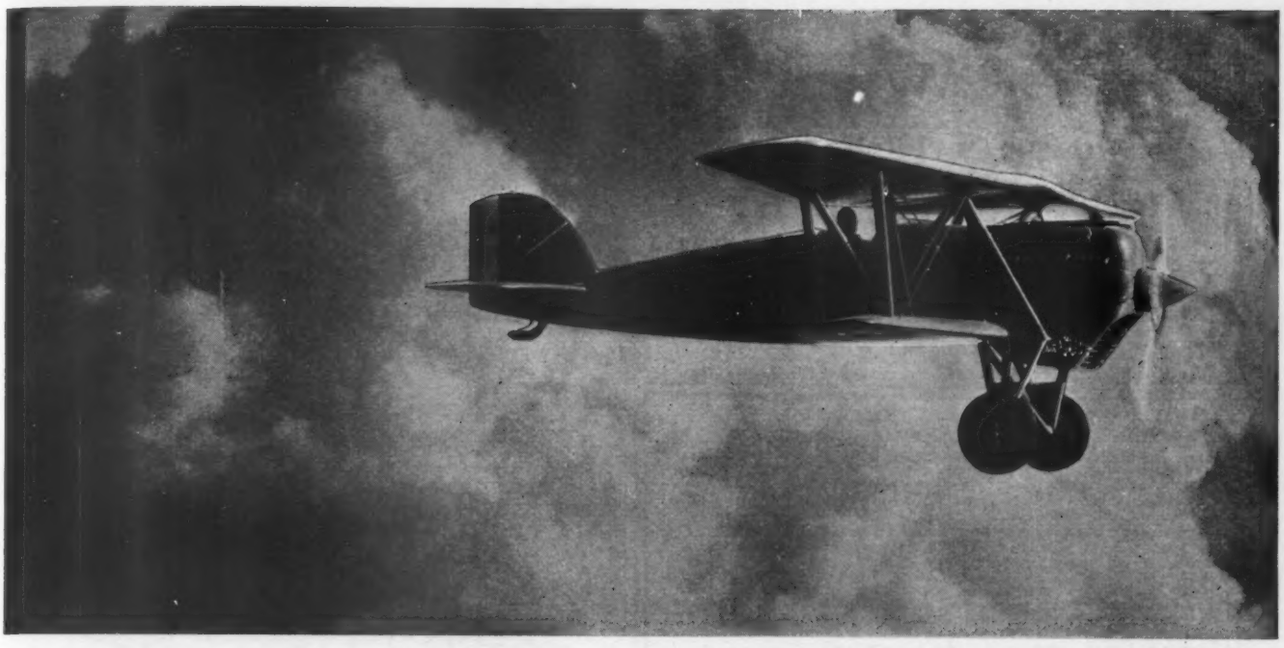
Our headquarters are now in Detroit—at the Municipal Airport. Drop in and see us during the Show. And if you don't know about our facilities for "serving you in the Great Lakes Region," let us tell you all about them.

Installing an outboard Wasp in our Cleveland Service Station

On your way to the Show stop at our hangars. We maintain parts depots and service stations at Detroit, Cleveland, Pontiac, Chicago, Kalamazoo, South Bend and Bay City, with completely equipped repair shops at Cleveland and Pontiac. And on major overhaul jobs we go anywhere. Ask us for full particulars.

TAC

Thompson Aeronautical Corp.
Authorized Wright, Pratt & Whitney, and Kinner Service
DETROIT MUNICIPAL AIRPORT • • TELEPHONE PINGREE 7000



165 M.P.H.

—— *even in 1923* ★

This fast-flying, fast-diving Army pursuit ship was the first standard high-powered water-cooled model built in the United States. Because it embodied the famous Boeing stamina and anticipated a number of future developments, several are *still* in service — another instance of Boeing construction years ahead of its time. Boeing Airplane Company, Seattle, Subsidiary United Aircraft & Transport Corporation.

★ **BOEING**
has *always* built
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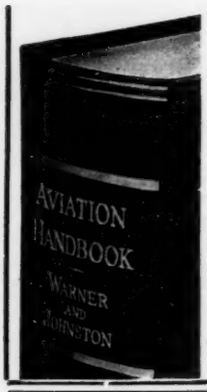

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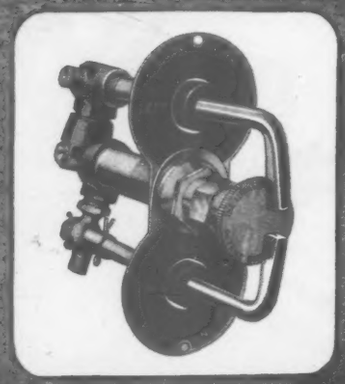

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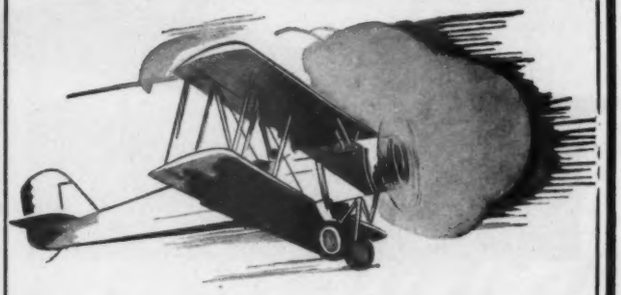

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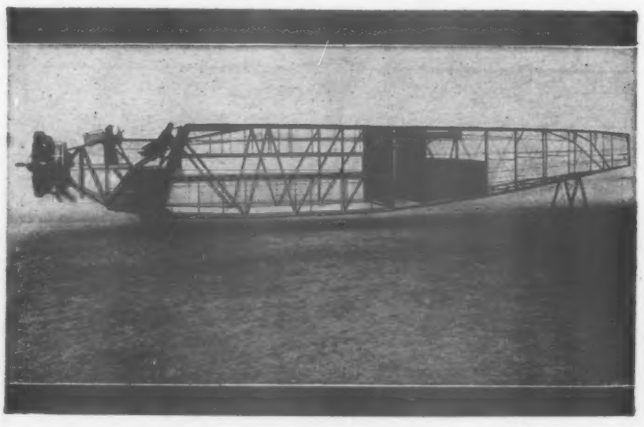

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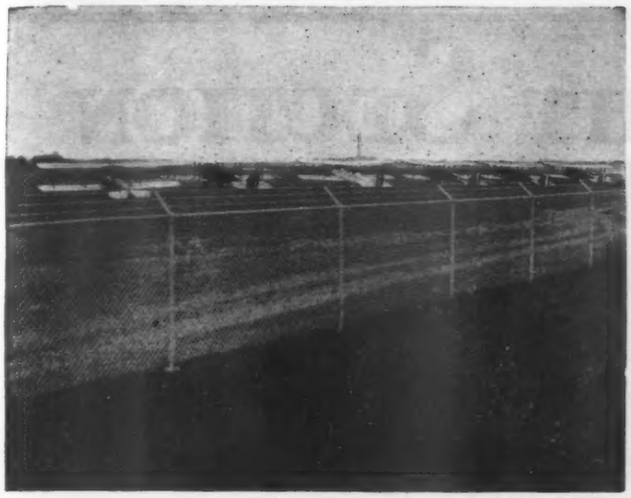

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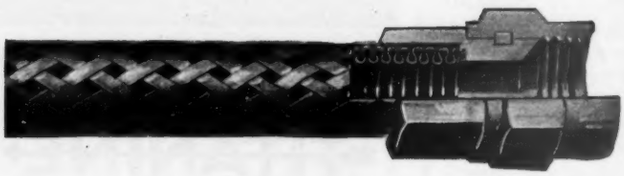

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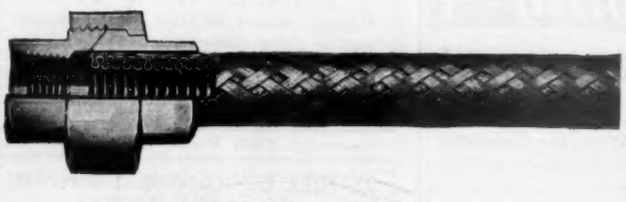

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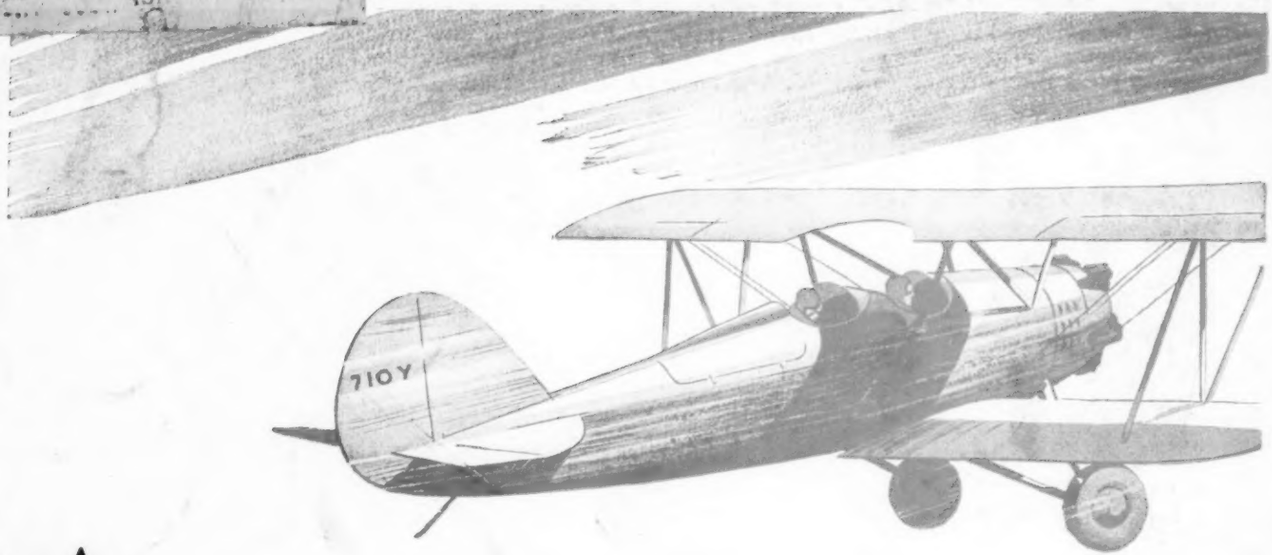

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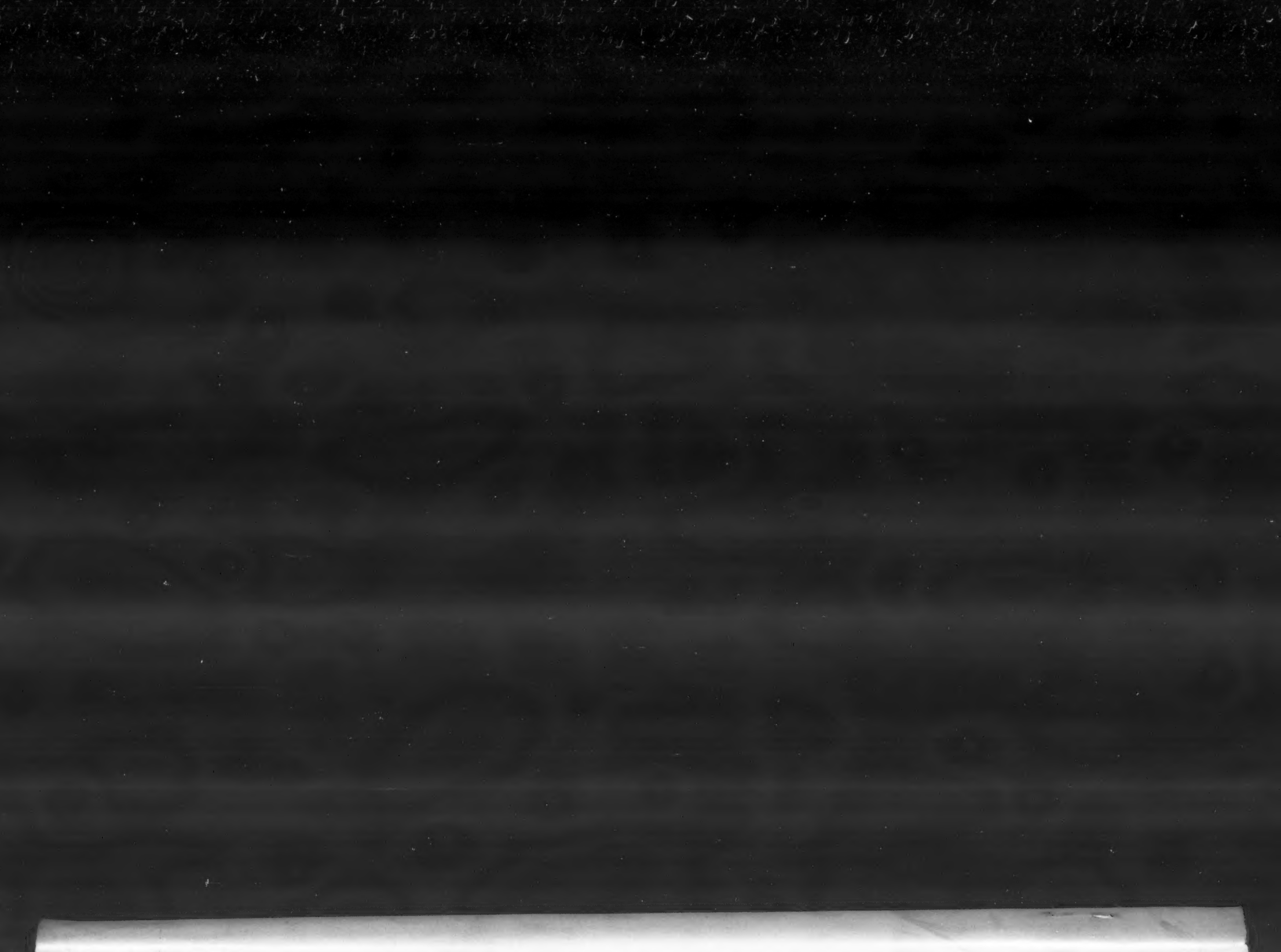
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